JUN 7 1911

36

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second-class matter May 7, 1906' at the Post Office at San Francisco Cal., under the act of Congress March 3, 1879

VOL. XXVI NO. 22 | SAN FRANCISCO, JUNE 3, 1911 | PER COPY, 25 CENTS

"THOMAS QUALITY"

Porcelain Insulators

R. THOMAS & SONS COMPANY

Represented on the Pacific Coast by the

"SAVE TIME AND FREIGHT"

DYNAMOS-MOTORS-TRANSFORMERS-ARMATURES-FIELDS-TELEPHONES-SUPPLIES

WESTERN ELECTRIC COMPANY

"TELEPHONE OUR NEAREST HOUSE."

These insulators are made in every type for transmission line, catenary, telephone, inlet, wall, floor, tank, switch, lightning arrester, storage battery, interior wiring, etc.

They are designed and guaranteed to meet the most rigid specifications of engineers engaged in the designing of transmission lines and all accessory equipment. Submit your requirements.

Western-Electric COMPANY

San Francisco - - - Seattle - - - - Los Angeles

LIBRARY OF CONGRESS JUN 8 1911 PERIODICAL DIV.

FOR INDEX TO ADVERTISEMENTS SEE PAGE EIGHT

Overnight Shipment
of
Western-Electric
TRADE MARK
Hawthorn Fan Motors

Don't let any sales get away from you because of shortage in stock. We will ship you any size or type of fan you need the day your order comes in.

WRITE OR WIRE US.

The Western Electric Company Furnishes Equipment for Every Electrical Need

Western-Electric COMPANY

New York	Chicago	Manufacturer of the 5,000,000 "Bell" Telephones	St. Louis	San Francisco
Philadelphia	Indianapolis		Kansas City	Los Angeles
Boston	Cincinnati		Denver	Seattle
Pittsburg	Minneapolis		Dallas	Salt Lake City
Atlanta	Milwaukee		Omaha	Portland
Buffalo	St. Paul			Oakland

Montreal Toronto Winnipeg Vancouver Tokyo
Antwerp London Berlin Paris Johannesburg Sydney

Sprague Electric MOTORS
Meet Every Requirement

A. C.
1/30 H. P.
to
50 H. P.
D. C.
1/30 H. P.
to
500 H. P.

THE MOTORS THAT DO THE WORK

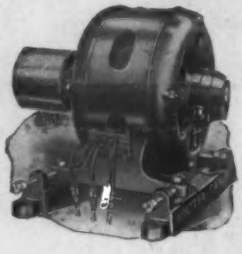
Round Type Motor Direct Connected to Davidson Fan

Bulletin No. 81054 on Application

ADDRESS

527-531 West 34th St. — SPRAGUE ELECTRIC — **New York City**

SAN FRANCISCO, Atlas Bldg. **SEATTLE, Colman Bldg.**



Holtzer-Cabot Polyphase Motors

Well Balanced Designs
result from giving the proper weight to the conflicting requirements of overload capacity, starting torque, efficiency, power factor, etc.

U. S. Government Specifications
are admittedly exacting and require motors to have good performance in all respects. Holtzer-Cabot standard motors meet the government specifications and in addition have many good features not required by them.

The Holtzer-Cabot Electric Co.
BOSTON CHICAGO
Telephone-Electric Equipment Co.
PACIFIC COAST AGENTS

GRIMSHAW

Our Tapes are made of the strongest sheeting obtainable. The compound is rubber, not tar or pitch and it is calendered into, not merely spread on the sheeting. These features are costly but they make tapes that are stronger, stick faster, insulate better, and keep fresh longer than brands without them.

Insulating Tapes

The extra quality is more than worth the extra cost. Increased annual sales for over a quarter century shows others have found it so.
You will too—try these brands the next tape you buy.
From your dealer or

New York Insulated Wire Co.
NEW YORK BOSTON CHICAGO
San Francisco, - 629 Howard Street
Seattle, - 416 Amer. Bank Bldg.
Los Angeles, - 221 Grosse Bldg.

COMPETITION

B 2 36 054

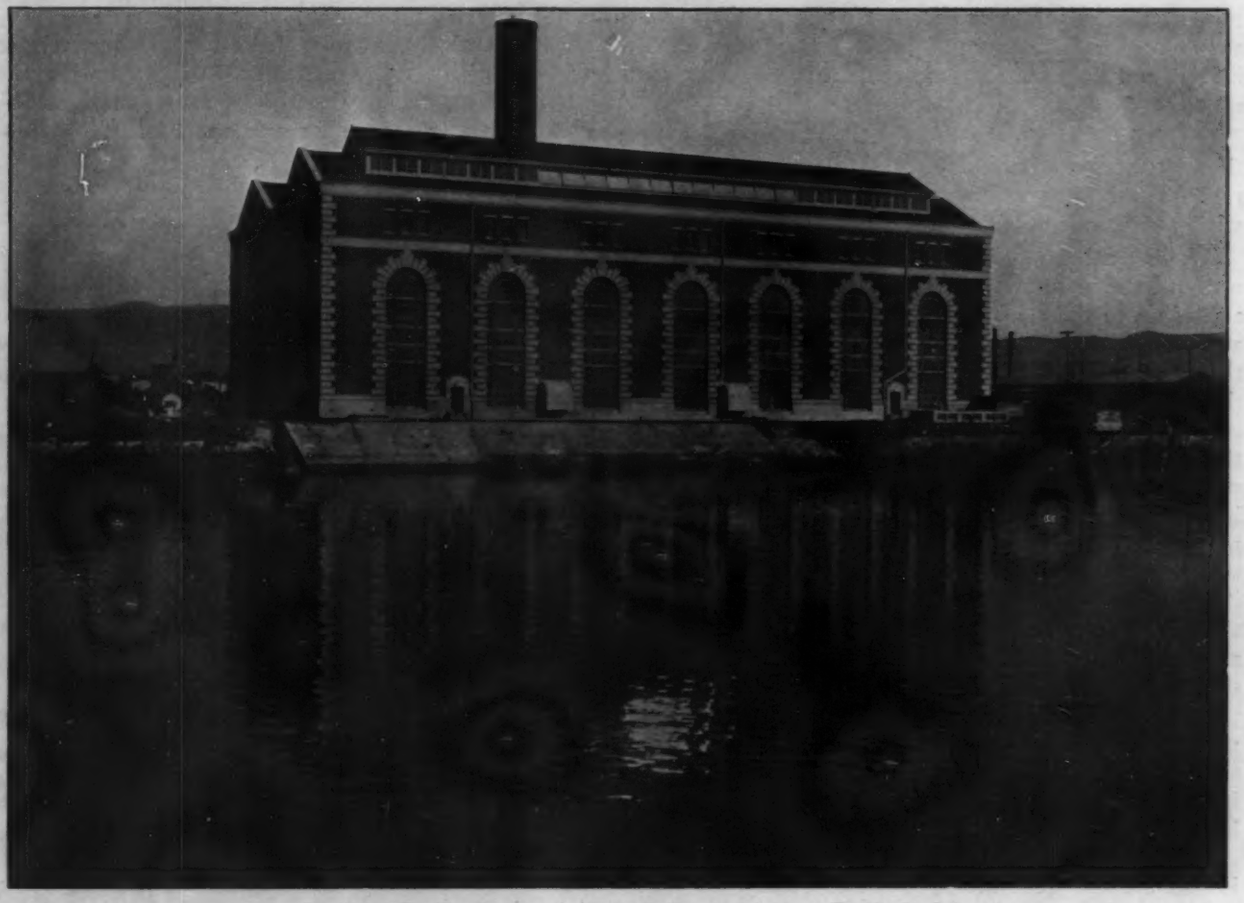
JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXVI | SAN FRANCISCO, JUNE 3, 1911 | NUMBER 22

[Copyright 1911, by Technical Publishing Company]

THE FRUITVALE POWER PLANT[1]

S. J. Lisberger: The meeting will please come to order. We have been accorded a most unusual courtesy tonight, that of being invited to hold our meeting in this power house. We are still to be accorded a more unusual courtesy, namely, to listen to a description of the engineering details of a modern plant illustrated by the plant itself. The man who is responsible for this great work, and who knows all about it, will tell us how it was done. I take pleasure in introducing to you Mr. Babcock, who will preside tonight.



Southern Pacific Company's Electric Power Plant at Fruitvale, Cal.

A. H. Babcock: The chairman has referred to the man who is responsible, and who knows all about it, and who will tell you what happened. Now, there is only one fact in his statement. There is, of course, somebody responsible, in the ultimate, for a work of this kind, but he can not know it all. Any man who has a piece of work of this kind to handle is dependent absolutely on the men associated with him, who carry the detail, and who bear the burden of such an enterprise.

It is not my purpose to try to tell you anything about this plant other than the general features and the general intention, and I will leave the description of the details entirely to those who designed them, the associate and assistant engineers of my office. In the first place, it may be well to state the general purposes of the plant. The electrification of all the lines around San Francisco Bay, generally speaking, is the ultimate purpose—that is to say, all of the lines on both sides of the Bay. The first step is being made now; the other steps will follow as fast as the service conditions will

[1]Papers presented at meeting of the San Francisco Section of the American Institute of Electrical Engineers at the Fruitvale Power House of the Southern Pacific Company, May 19, 1911.

warrant the expenditure of the necessary money.

The location of the plant was determined by the usual two or three conditions that control such selections, namely, the presence of condensing water at low temperature available in large quantities; a piece of ground not too expensive, and a soil that will not demand expensive foundations. (The ordinary fuel requirements do not apply here).

The general scheme of the power house installation is:

First: A 13,200 volt, 25 cycle, 3-phase generating system for distribution to substations in accordance with the traffic requirements; and also for the supply of a high tension transformer house to take care of the further extensions to the suburban system just mentioned.

Second: Entirely independent of the large generating apparatus in the station is installed a 125-250 volt direct current system for the supply of all the generating excitation circuits, the station lighting circuits, the crane and all the station auxiliaries. This direct current system is reinforced by a storage battery to insure a continuous supply of power for the station auxiliaries and lights in case of accident to the main generators.

Third: Within the main station is located one of the substations with its conversion and control apparatus suitable to supply power to the trolley lines within economic reach of this point.

The station at present designed is to hold four units of approximately the unit capacity of 5000 kw., according to the contract for the generating units. As a matter of fact these units are so liberally designed that under test conditions it was impossible to raise their temperatures beyond the contract guarantees until a continuous load of 7500 kw. had been applied to them. It follows then that with the two units installed there is practically 15,000 kw. capacity available in the present installation or with four such units the present building can provide easily 30,000 kw. output; and the west wall is constructed in such fashion that it really amounts to a temporary wall, beyond which there is available space for the installation of two more similar units, or a total of 45,000 kw. station capacity.

At the other end of the station, namely, where this meeting is now being held, three 1500 kw. rotary units are installed, and where your chairs are now placed it is intended to install three similar units whenever the suburban train requirements shall require the additional capacity. The rotaries are designed in as liberal fashion as are the generators. Although they are nominally 1500 kw. capacity per unit, a continuous load of 2250 kw. is required to bring them to their safe operating temperatures; and the commutation under extremely fluctuating conditions is all that can be desired.

The building was designed in this fashion, i. e., larger than present requirements demand, in accordance with instructions received from Executive Officials to provide for sufficient capacity to take care of all of the load, present and for some time in the future, that may be developed when the entire electrification of the Bay district shall have been completed. Also, in accordance with similar instructions the boiler room and its facilities have been designed for conversion to coal firing later, whenever the fuel conditions of this market shall make such a change desirable. There is ample space over and alongside of the boilers for coal handling and automatic stoking apparatus, and under the boilers a suitable space has been left to take care of the ash handling apparatus: in other words, while the plant is now being oil fired, if the market conditions make it desirable we can change to coal at a comparatively slight expense. The ground to the east of the power house has already been laid out for coal storage and conveying apparatus.

It is with considerable regret that I have to say tonight that Mr. Miller, who is responsible for the mechanical design of this plant and for the design of the steel structure that is enclosed within these walls felt obliged to go out of town and will not be present. I hoped that he would be here to give you in greater detail than I can a description of that part of the work for which he is responsible.

The design of this building, that I think you all will agree with me, is unique and proper in every respect, is entirely due to D. J. Patterson, formerly architect for the Southern Pacific Company. He is responsible for the architectural features, and I wish to call on Mr. Patterson for a few words as to that part of the outfit.

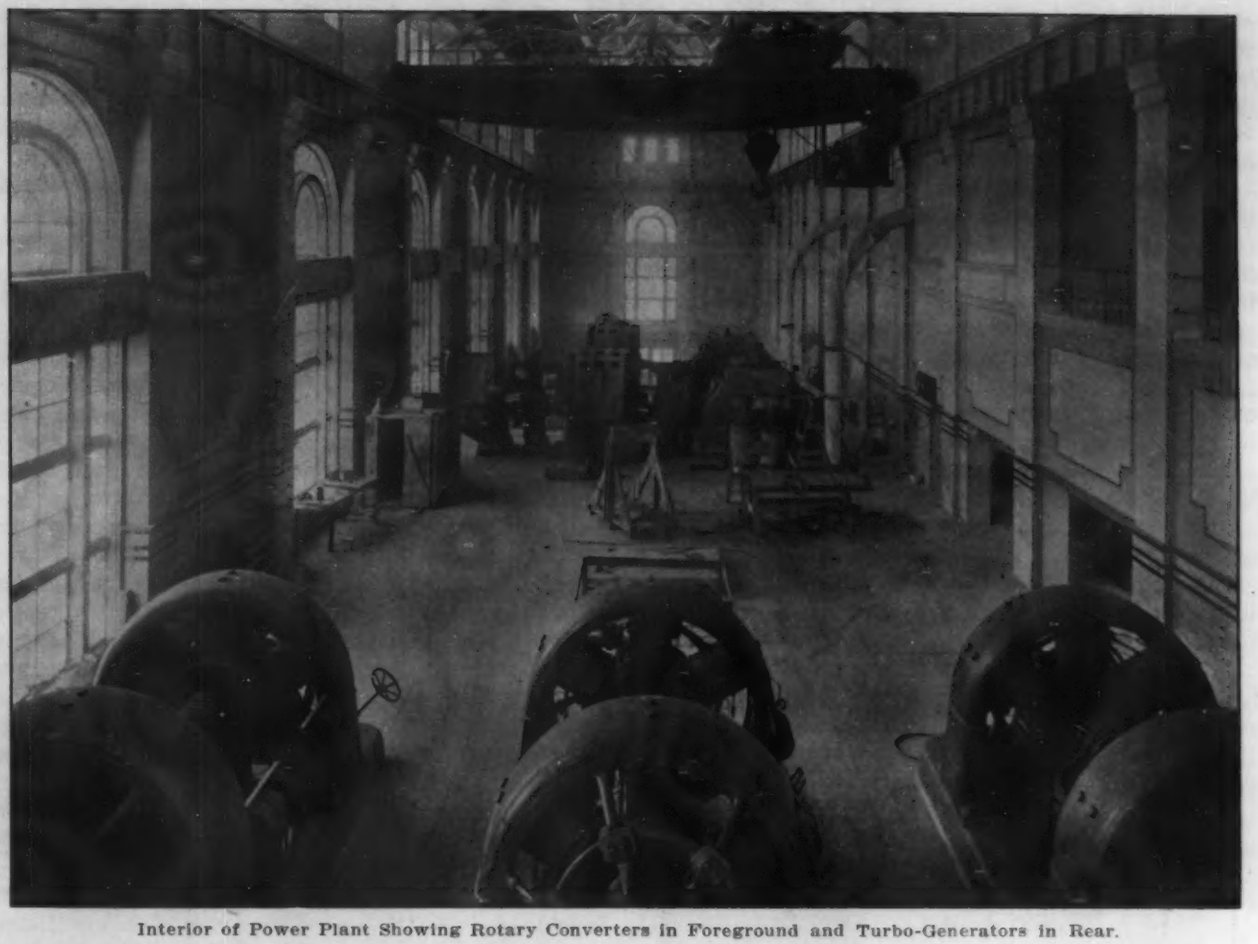
Architectural Features.

D. J. Patterson: Until a few moments ago I did not know that I was to be called upon to say anything. In the spring of 1907, at the suggestion of Mr. Babcock, I made a trip through the East to the various cities that had constructed large power plants, and thereby gained such information as would be necessary in building this structure. In September of that year I met Mr. Babcock in Schenectady, New York, to get instructions from him, and armed with letters of introduction I visited the cities of New York, Boston, Philadelphia, Pittsburg and Chicago.

The idea was to gain as much knowledge as possible that might be used in the construction of this building, although it is greatly modified in form from anything that I saw. No doubt many of you who have visited the East noticed that these buildings are elaborate; in fact the expense in many instances has not been considered at all, but we out in the West consider the best way to spend our money and get the most out of it, and from the things that I saw and the information I gained I obtained my ideas that were used in the construction of this building.

The exterior of this building is constructed of ordinary building material, such as is used in the construction of common warehouses. Everything throughout was built in that sense until we got to the interior of the building.

The idea was to make this building look the best possible on the inside and not go to any great expense. One thing you will observe here, and Mr. Babcock instilled it very strongly into my mind, is the floor. The floors has been a great fault in all buildings of this character because of their getting stained and marked by oil, and we looked carefully into the material to be used. The tiling of this floor was put through a severe test. Every class of material was



Interior of Power Plant Showing Rotary Converters in Foreground and Turbo-Generators in Rear.

thoroughly tested until we found what we thought would meet the requirements, and to a certain extent I think we have succeeded in accomplishing the purpose. The interior of the building, as you will see, is ornamented in a simple way compared to other structures of this character. The tiling of the wainscoting can easily be kept clean, and above that the walls are covered with ordinary plaster which was painted with three coats of ordinary paint and decorated in the manner that you have seen. The object has been to not over-ornament the building, not over-decorate it, but to make the place a harmonious whole in keeping with the character of the structure. That is the colors of the floors and walls were all so designed that they would be one harmonious whole and be entirely in keeping with the character of the building that it was designed for.

A. H. Babcock: I feel that Mr. Patterson has not said as much as might be said about the building. The steel frame that is enclosed within the walls was designed by J. C. Lathrop, who is now in an eastern engineering office. The steel was fabricated at the American Bridge Company's plant, then sent out here and was erected by the bridge force of the Southern Pacific Company. When the steel plans were sent to us by the bridge company they were checked in the office through a process that will be given to you later in detail. Any additions to the steel structure were noted, any parts that were not to be used were noted, and a complete memorandum of those changes, additions and subtractions was given to the bridge foreman, when the bridge crew went to work. He told me some months after the structure was completed that in every instance Mr. Miller's check of the drawings had come out exactly as was given in that memorandum; the things that were not to be used they did not have to use; and the things that had to be added were found necessary in every instance. I merely mention that as a tribute to the business skill of an engineer. Usually it is considered that an engineer has not much business sense; but I would like you all to understand that Mr. Miller has both engineering skill, which you now see, and has also business sense as evidenced in the other way.

In Mr. Miller's absence I shall ask Mr. Ferrier, office engineer and assistant to Mr. Miller, to give us as near as possible the description of the plant that Mr. Miller would have given if he were able to be here; also in addition to that, to state briefly the manner in which such engineering is carried through the office. He will begin with the orders of the general manager to prepare estimates upon which to ask for an appropriation; the procedure that is followed when the appropriation is made, and the routine of the office through which the contracts, specifications and drawings are carried before the work goes into construction.

Details of Office Engineering.

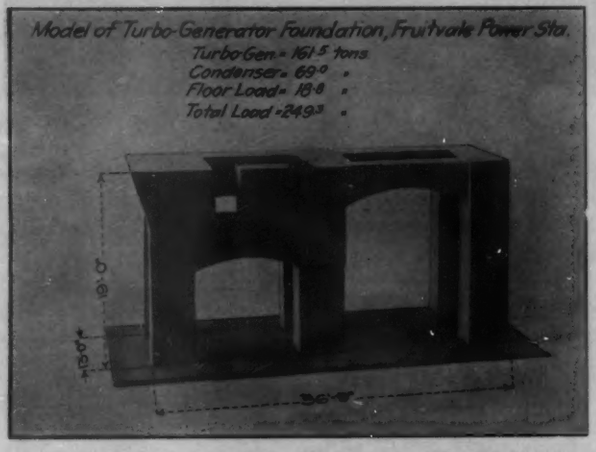
J. J. Ferrier: One of the features of electrification work seldom brought into discussion, primarily because of the importance of the construction features, is that of office engineering. In the beginning estimates

are prepared and submitted to the management for what is called an "A F E" (authority for expenditure.) Considerable care is necessary in preparing such estimates for obvious reasons. When the expenditure is authoried it becomes a "G. M. O.," (general manager's order), against which all charges are made.

Having determined the possible arrangements, we then issue a requisition on the General Store Keeper for the material, for the larger material, he in turn places an order on the General Purchasing Agent who in turn sends out invitations for bids. The bids when received are sent by him to the Electrical Engineer's office for his recommendation.

For the purpose of determining the best interests of the company a comparison chart is made of all the bids and the results are easily arrived at. If the manufacturers or agents send their proposals in, along the lines specified, our work is expedited. We also use a clause permitting bidders to make proposals on similar material. Recommendation is then made to the General Purchasing Agent embodying also our suggestion for the terms of payment, and in the large orders, certain contract clauses.

At this time request is made for outline drawings of the successful bidder that final designs may be made of the arrangement and buildings. Paper templets of the machinery are great time savers at this point of the work; cardboard models were also made of the turbo-


Model of Turbo-Generator Foundation, Fruitvale Power Sta.
Turbo-Gen = 161·5 tons
Condenser = 69·0 "
Floor Load = 18·0 "
Total Load = 249·3 "

Cardboard Model of Turbo-Generator Foundation.

generator foundations, and the smoke flues, which all helped to get to a conclusion. Color schemes can be used to good advantage at this time in laying out the different piping schemes. Approximately 550 drawings and 50 sets of specifications were made and finished in our office of the power house and sub-station work.

About this time the contractor takes up his correspondence with the Electrical Engineer's office; drawings are received and checked by us to the contract requirements. The errors and changes that have developed on this work were many and considerable trouble in the field was saved by having the errors rectified on the drawings. All drawings received on this work both from contractor or our associate offices are checked by at least two men for design and errors, and their report when culled forms the body of the letter to the contractor. Each man uses a distinct color in checking the prints, etc.; the entire check is left upon the office sets, and only those remarks that are of importance go on the set which is returned to the contractor.

The contractor then submits revised plans and these go through the same routine and when finally approved, Van Dykes or negative prints, are sent to the company, and we then make our own prints for distribution.

It is surprising the number of times that some drawings had to go through the mail. An Eastern engineer can hardly appreciate that it takes from two weeks to a month to get replies from the East. In other words, before going 3,000 miles a subject wants to be clearly defined. Of course, we have telegraph communication and some contracts have been placed almost entirely by telegraph.

After approval of drawings we send specifications and drawings to an inspection firm if the contract is in the East, or to our own inspector if the contract is local. This has insured our getting what was specified and in the event of necessary changes we were advised in time to arrange accordingly. It also kept us in touch with the progress of the work and expected shipping dates. Tests were also made at the factories.

The shipment and delivery of material is then made to the Division Storekeeper of the company who in turn notifies us of its arrival, and obtains from us the directions of re-shipment. Considerable work is involved in tracing material to destination. Subsequent erection follows. Daily reports from the men in the field are sent to the Electrical Engineer's office, and customary tests and acceptance or rejection followed.

As to the payments, the policy of the Electrical Engineer's office is for standardization although consideration is given the contractors when framing terms of payment. He has his current expenses to meet, and much aggravation and hard feeling can be stirred up by neglect in making proper arrangements. The usual ten per cent generally is reserved for final payment until written acceptance is given, providing delays by the purchaser are taken care of. Some of these contracts had payments made on the amount of work done and others had a fixed amount at stipulated times.

The bills for the material are usually sent to the General Purchasing Agent who certifies to the price being correct; he in turn sends the bills to the Electrical Engineer who passes upon the technical details, the receipt of material and the desirability of making final payment. The Purchasing Agent then sends the bills to the Auditor who in turn makes the voucher or check out and passes voucher through the Electrical Engineer's office. From this source we obtain our records of the costs both unit and in the aggregate, for guidance in future work, to assist in facilitating further expenditure on the same work, and to give information as to how much money is left in the G. M. O..

A very carefully prepared detailed record is also kept of the engineering cost on each specific G. M. O. Unless this is done and the distribution of it properly controlled it is surprising how the money provided for in the estimate can get away apparently from the purpose for which it is intended.

A weekly report from the respective subordinate

heads in our office was required so that the entire work could be completely reviewed. It has been shown by experience that while reports of this nature bother us by constantly recurring on given dates, usually they bring to attention matters that otherwise might be overlooked.

Very little overtime work has been allowed to be done by our forces. This to my mind explains in some measure why no serious error has been recorded on this work.

All drawings have been made to standard sizes; this brings about economy in filing space occupied, and the preservation of the drawings has resulted. Numerical and alphabetical indexes are kept.

An interesting feature is the use of a fire proof vault. Arrangements have been made to store in this building complete copies of all drawings and specifications beyond the reach of fire. This will prevent disorganization of the office in case of fire or theft. The speaker recalls that on similar work in the east every man in the office had a duty to perform in case of fire during the day; and suggests that possibly it is a good practical thing to be instituted in every office.

Correspondence has been reduced to the fewest letters possible, and to one subject for one letter. Carbon copies are made for each of the subject files and filed according to date. All letters and requisitions are given a serial number by an automatic numbering machine; this makes an easy reference. In addition to the subject files an extra copy on yellow paper is made and filed numerically and these have proven extremely useful in many instances. We have an effective system of tracing delayed correspondence, both on others and ourselves. All inter-office memoranda is carefully preserved and from experience we have learned the value of so doing.

A system of photography was introduced early in this work and progress photographs have been taken almost weekly. The results have demonstrated the wisdom of this introduction, and an explanation can be thoroughly made to any one with the picture before them. In case of accidents it proves a truthful witness. When dealing with franchises it is useful to be able to show that work was started or completed as the case may be within the specified time.

A. H. Babcock: While Mr. Ferrier is looking up his memoranda, I want to say one word in tribute to the men who have carried on that part of the work. The checking system just described by Mr. Ferrier was put in effect by Mr. Miller, with the result that considering the building where you are, in all the work that has gone through my office, there has not been a single extra on any contract, and there has not been a mistake to be rectified. That in itself speaks for the system, and the men who handled it.

Steam Details.

J. J. Ferrier: Mr. Babcock has taken up the general features of the plant, and I will now try to point out to you some of the details of the plant.

The turbo-generators are of the Westinghouse double flow type, 5000 kw. rated capacity, guaranteed for twice their rated load for one minute, and for 7500 kw. for two hours. The steam consumption at rated load was guaranteed not to exceed 15.9 lb. per kw. hour with superheated steam, and 18.2 with saturated steam and 1.10 load is guaranteed when operating non-condensing. The contract requirements are as follows: For 2500 kw. load the steam consumption is 18.3 lb. per kw.-hour. The Westinghouse tests showed 18.1; at 3750 the contract requirements were 16.7; the test developed 16.6; at 5000 kw. the requirements were 15.9 and that developed was 15.8; at 6250 the requirements were 16.3 and that developed 15.3; and at 7500 the guaranteed requirements were 17.5 and they developed 15. There is very little difference in the results of the tests of the two machines.

As to the surface condensers, they are of the Henry R. Worthington type. The tubes are not tinned. The circulating water is taken from the canal. The temperature of this water was taken during a period of a year and the maximum temperature of the circulating water was 65 degrees F. and the minimum 46 degrees F. We have both condensers inter-connected. We can use either circulating pump on either of the condensers, so that in case either turbine is running, and we should be so unfortunate as to have one of the circulating units go out, the other one could be used on either or both condensers. The air pumps are arranged so that cross connection can be made. The boilers are of the Parker type steam generators. There are twelve installed, each of 645 h.p. normal rating, and the results of the tests are briefly as follows: The guarantee was the equivalent evaporation of 14 lb. of water from and at 212 degrees F. per 1 lb. of oil, and the performance, developed 15.96 and 16.01. We have two tests recorded and the horse power developed on these tests was 676.7 and 650. The apparent water evaporation under actual conditions per pound of oil as fired was 13.25 and 12.79, and the equivalent evaporation from and at 212 degrees F. per pound of oil as fired was 15.77 and 15.91 respectively.

The customary flue gas, temperatures, etc., were all taken. The average steam pressure measured by gauge was 178 and 179 lb. and the oil pressure at the burners was 78 and 92 lb. The escaping gases from the boiler were 384 degrees F. The temperature of the oil at the burners was 128 degrees F. in one test and 113 degrees F. in the other. The temperature of the feed water into the boiler was 165 degrees F. and 123 degrees F., and the degree of super-heat was 160 and 181 degrees F., respectively.

The burners are of the Owens type and a test for the amount of steam used by them was as follows: There being three burners to each boiler, 4.16 per cent of the total steam generated; 0.528 lb. of steam being required to atomize one pound of oil.

The stack is of unlined steel, and as shown on the drawing it is 125 ft. above the boiler room floor and 139 ft. above the ground. It is arranged so that this stack can be extended at any time. You will also note that the stack does not come down to the boiler room floor, thereby gaining increased floor space. The flues are of unlined steel and are also designed for extension. Provision is also made for future installation of forced draught apparatus if required under coal firing.

The dampers are hand controlled, and provision is made so that automatic attachment can be made at any

time. We also have an electric pyrometer that is going to be installed, and wiring arranged so that the temperature can be taken from each boiler uptake.

With reference to the 60 ton Shaw electrical traveling crane, and its 10 ton auxiliary hoist, there is not much that can be said. You have seen it in operation, and it has demonstrated to us its capabilities. It more than fulfilled the specified requirements on the light load tests which were made very early in the construction of this building. In this connection provision is made for removing a portion of the floor to facilitate the handling of transformers, and the condenser heads.

Boiler-Room Showing Stack Construction.

We have also installed a 1000 gallon Henry R. Worthington fire pump. It can also be used as an auxiliary feed pump. When the city water pressure is low, and when we are using city water, it is connected to the city water system and will draw from that system and deliver into the feed system. It is also available for use in case of fire around the building, and will be a necessity when this neighborhood is more thickly settled.

The feed pumps consist of one Alberger high speed, turbine driven centrifugal pump, and one Henry R. Worthington reciprocating, double acting pump.

There are also four Dow oil pumps, and two heaters installed in the basement which deliver the oil to the burners at about 80 lb. pressure. There are two Dean pumps for unloading the oil from the cars. We can unload eight cars at a time and the entire pumping operation is handled from the inside of this building. The oil is pumped into the storage tank by this method; from thence it flows by gravity into the suction of the four pumps, and from there through the heaters to the burners. We have also installed a heater at the storage tank for use in cold weather to facilitate the flowing of the oil.

We have two sources of water supply. One is from the city water, which is secondary, and two deep wells driven to a depth of about 460 feet. We have the deep well pumps operating to supply the feed water. There is a 5000 gallon tank on the roof from which this water is supplied to the hot well in the basement, thence to the suction lines of the feed pumps.

We have an air compressor installed with an operating pressure of about 70 lb. You have been introduced to both the steam and air whistles, which are used for operating purposes. The compressor is of the Westinghouse air brake type, separate reservoirs being installed for the whistle and the receiver tank. The capacity is about 55 cu. ft. at 50 lb. pressure.

We have installed here a machine shop, in which is contained motor driven tools as follows: One 24 in. x 18 ft. Fay & Scott engine lathe; one 25 in. Aurora stationery head drill; one No. 2 Bridgeport combination wet and dry grinder; one 13 in. x 10 ft. Young engine lathe; one 16 in. Smith & Mills gear and crank shaper; also a metal tool rack locker. Metal lockers are to be installed for the purpose of containing the clothing of the operators.

Most of the gauges installed in this plant are furnished by the Star Brass Manufacturing Company, except those which are provided by the separate contractors.

The flues were designed in the electrical engineer's office and were fabricated by the American Bridge Company, and as previously explained, erected by the Southern Pacific Company's bridge force.

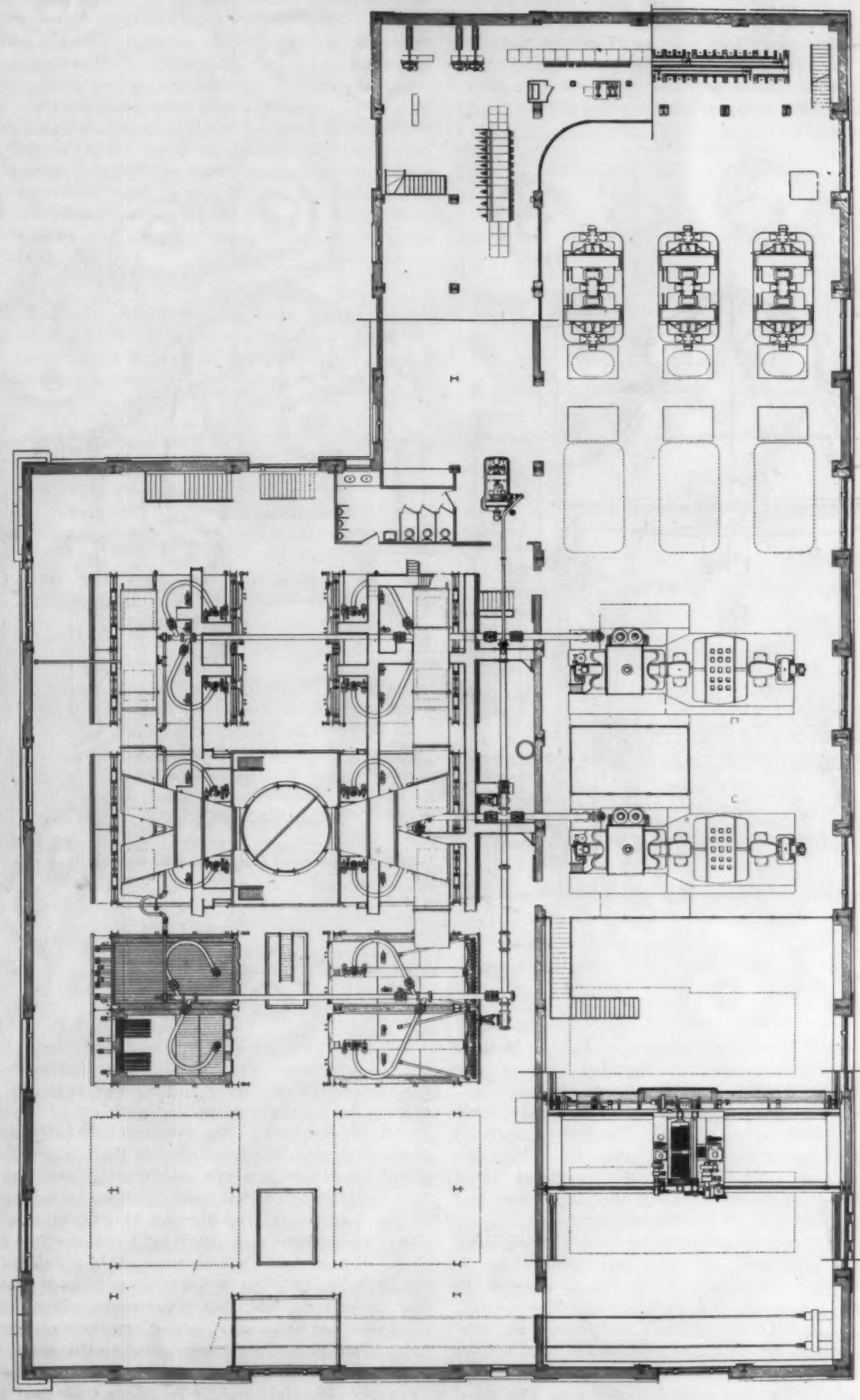
We have a closed feed water heater of the Wainwright type. It is used for saving the exhaust from the auxiliaries to heat the feed water.

We are now installing a separate system to save the discharge from the steam traps and the feed water heater condensate which is practically the only water wasted in the plant at the present moment. The condensate will be filtered and returned to the hot well. The investigation of that matter showed the desirability of returning that water which is at a much higher temperature than the water which comes from the transformer cooling system, and which is taken up to the roof and used over again. The dry vacuum pumps are of the Laidlaw-Dunn-Gordon type and are steam driven.

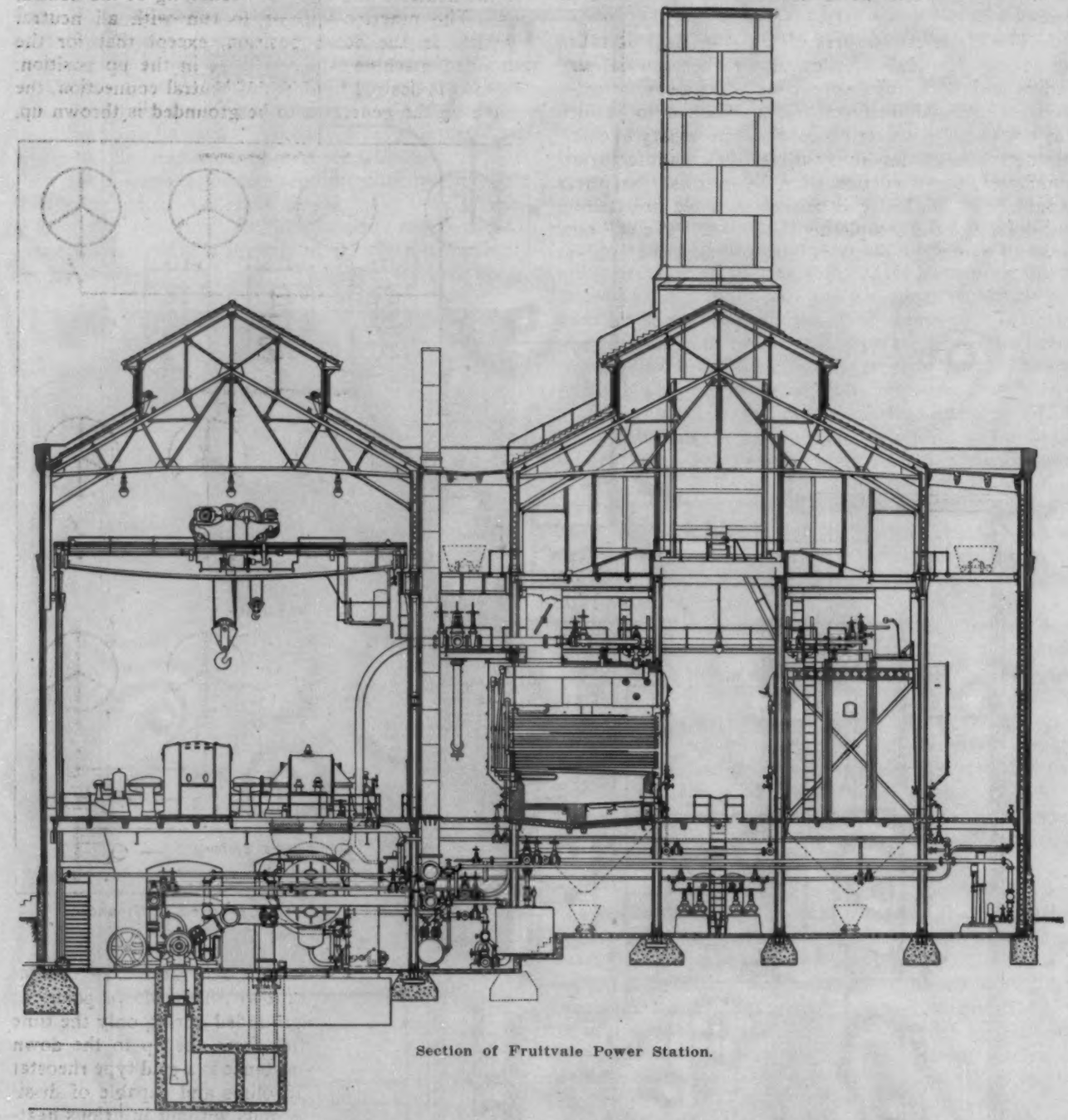
The piping of the plant was installed by the Pittsburg Valve Foundry & Construction Company. It was laid out in our office very very thoroughly. In fact the drawings that our office made were the drawings by which the piping was erected. No drawings were made by the piping contractor.

The piping systems include the main steam, the auxiliary steam, the main exhaust, auxiliary exhaust, boiler feed system, boiler blowoff water supply, lubricating piping, turbo generator gland seal, compressed air piping, and transformer oil and water system.

The pipe flanges in this building are Southern Pacific standard. They were based upon and derived from a comparative table of a number of manufacturers' design and they agree substantially with those



Plan of Fruitvale Power Station.



Section of Fruitvale Power Station.

made by well known manufacturers, but are a little heavier than those ordinarily supplied. Steam pipe flanges are of the Vanstone type generally.

The main steam valves are steel and were made by the Pittsburg valve people. The valves were all tested to 800 pounds hydraulic pressure. The main steam pipes were all erected at Pittsburg and tested out in the open to demonstrate their tightness and strength before they were shipped here.

For the operation of the power house the following forces have been laid out: The operation will be divided into three watches from 12 o'clock midnight to 8 o'clock in the morning; from 8 to 4 and from 4 to 12. On the first watch there will be a watch engineer, fireman and two oilers; on the second watch there will be a watch engineer, the water tender, fireman and two oilers, and a time and material clerk; on the third watch there will be a watch engineer, water tender, fireman and two oilers. Mr. William Redford will be superintendent of power and he was engaged as inspector during the construction period.

A. H. Babcock: Mr. Ferrier made brief mention of the fire vault lately installed in the building for the protection of our drawings, specifications and contracts. The installation of that was strongly forced upon us by our experience after the fire of 1906 in San Francisco, when there was practically nothing left in the shape of records with which we could go ahead with our business, and it occurred to some of us at that time that we better not let that occur again. This building is as near fire proof as anything can be made, and the vault is put down in the basement, so that even in the event of a general conflagration such as we had in San Francisco, it would hardly be likely that heat would

be developed sufficient to destroy the vault with its contents.

The electrical features of the plant will be taken up next by Mr. Hall. Following a rather unusual procedure detail drawings were made of the switchboard—in fact, the manufacturer was not asked to furnish any drawings whatever except those necessary to check his details. As far as possible the manufacturers' standards of construction were followed, so that there would be no difficulty in any responsible firm taking our drawings and completing the boards. We will now hear all about the electrical construction of the plant from Mr. Hall.

Electrical Details.

H. Y. Hall: As previously stated the generators are rated at 5000 k.v.a. at 40 degrees C. rise, but the actual temperature rises under 5000 kw. test were only 25.5 degrees in armature windings, 34 degrees in field windings and 34.2 degrees C. in armature iron so they will safely carry 7500 k.v.a. continuously. The air for ventilating the generators is taken from the outside of the station through screened galvanized iron ducts, but in foggy or damp weather the air can be taken from the turbine room basement, to avoid drawing moisture through the machines. The generators are star connected for 13,200 volt, 3-phase, 25 cycles, and have the neutral taps brought out for grounding, which is accomplished as shown in Fig. 2.

There are three schemes for the operation of grounded neutral systems, as exemplified by the practice of the Manhattan Railway Company, the N. Y. C. & H. R. Railway, and Southern Pacific Company. In view of the interest taken in Mr. Rhodes' paper before the Institute in San Francisco last June, it might be of interest to give a brief description of the advantages and disadvantages of the three schemes.

At the Manhattan Railway plant to prevent excessive triple harmonic cross currents between the generators only one generator at a time is connected to the ground bus. The advantage of the scheme is that the resistance between neutral and ground does not vary with the number of generators in operation, but is fixed and practically constant, thus allowing sufficient current to flow to the ground to trip the relay in case a feeder becomes grounded. The disadvantage of this scheme is that during the time consumed in transferring the ground connection from one generator to another the system is ungrounded. This scheme has proven satisfactory during seven years of service.

At the N. Y. C. plant it would be safe to operate with the neutral switches closed on all four machines if the two inter-connecting switches were open; very little cross current would flow in the neutrals. It is not advisable to operate with all neutral switches closed as there would be only 5 ohms resistance between neutral and ground, which would allow too much current to flow in case of a ground on a feeder. Two sets of resistances should be kept connected in whether there are one or more generators operating.

As will be seen from Fig. 2, the scheme being used by the Southern Pacific Company at its Fruitvale plant is the same as that used by the Manhattan Railway Company except the use of single-pole double-throw switches instead of single-pole single-throw switches for the neutrals and also the sectioning of the neutral bus. The practice will be to run with all neutral switches in the down position, except that for the grounded machine which will be in the up position. When it is desired to shift the neutral connection, the switch on the generator to be grounded is thrown up,

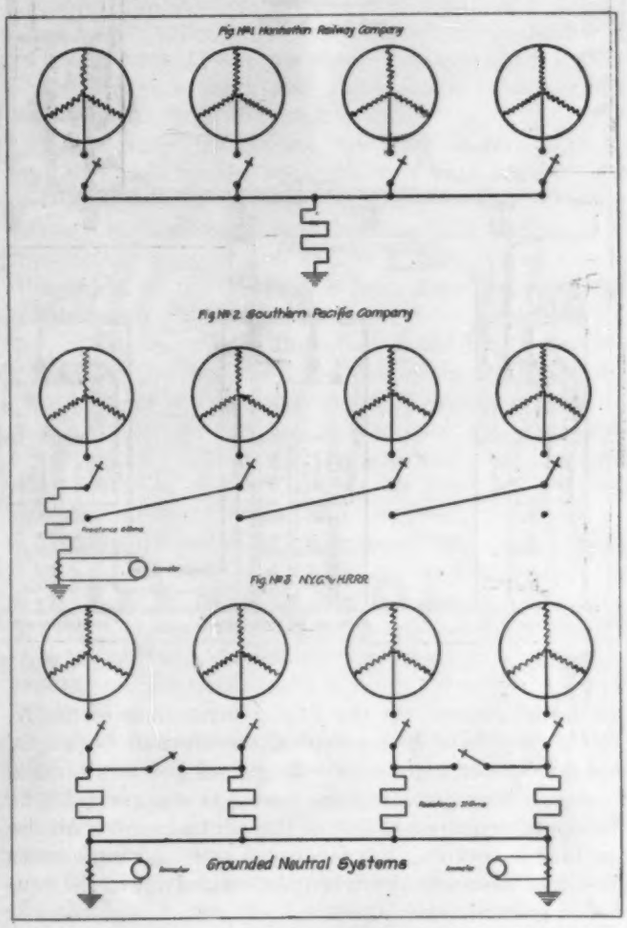
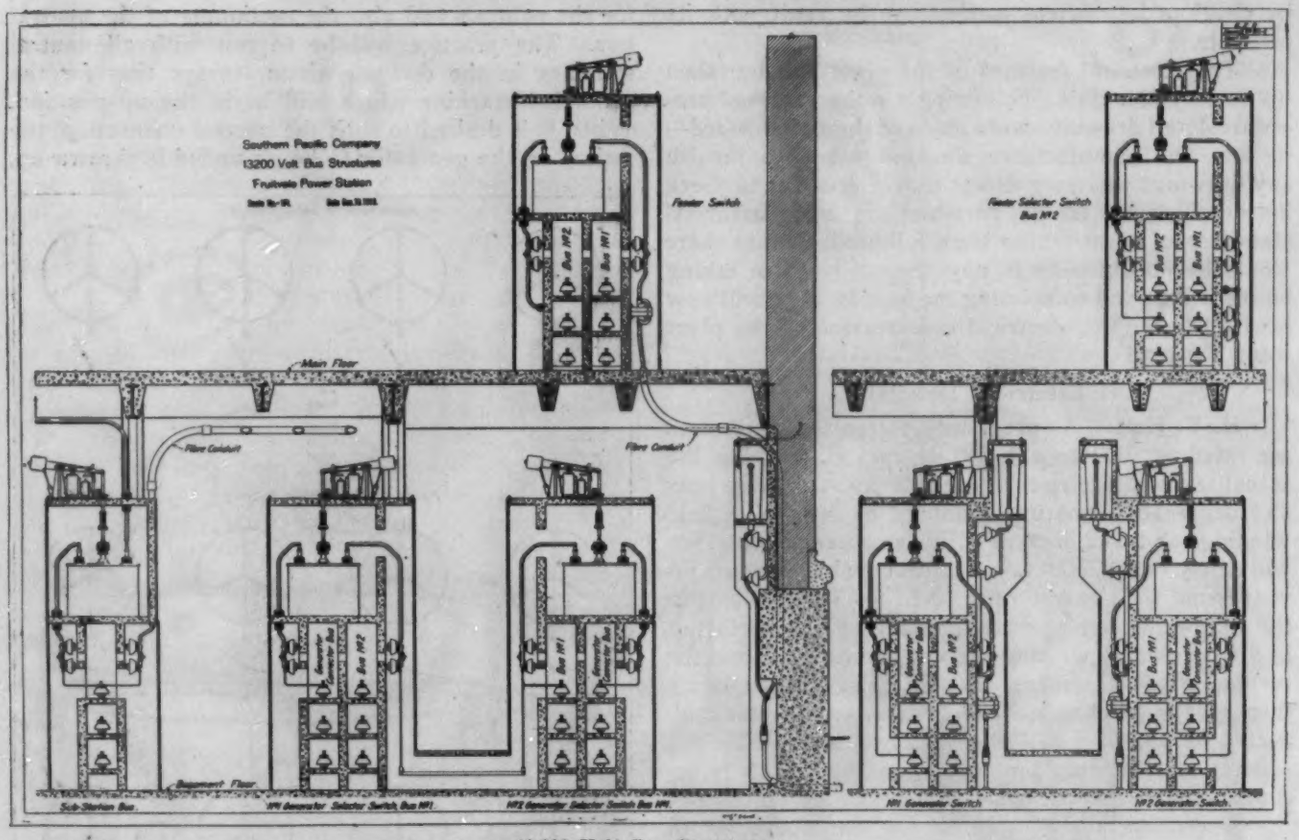


Diagram of Schemes for Operation of Grounded Neutral Systems.

after which the switch for the generator to be disconnected from ground is thrown to the down position; the system would be ungrounded during only the time it takes to throw a switch from the up to the down position. The neutral resistance is a grid type rheostat having a resistance of 13 ohms and capable of dissipating 6000 kw. for 30 seconds without injurious heating. With a dead ground on one phase of a feeder, this resistance would limit the current to 500 to 600 amperes which is sufficient to operate the automatics on the feeder; there are no automatic devices on the generators.

In connection with the installation and operation of grounded neutral systems, there is another point which should be borne in mind and that is the method of connection of potential transformers. If star connected potential transformers are used they should be connected to the neutrals of the machine, instead of to the neutral bus or the ground bus, for the neutral connection. If they are connected to the ground or neutral bus, whenever the system is running ungrounded the potential transformer voltages will be greatly unbalanced due to the difference in the loading of the poten-



13,200 Volt Bus Structures.

tial transformers. At the Port Morris plant of the N. Y. C., they have had potential transformer burnouts, due to 50 per cent over-voltage on potential transformers. The system at the time was not grounded as the operator forgot to put in the neutral switch on the machine in service. For feeders, potential transformers should be connected between phases and not to the neutral or ground.

In general, all 13,200 volt wiring in the building is run in Orangeburg fiber conduit, embedded in concrete. The generator leads and the outgoing feeders are No. 0000 single conductor cable with lead covered 14/32 varnished cambric insulation, terminating in Davis station terminals. The main generator leads are carried in conduit along the basement wall to the main generator switches.

There are two sets of 13,200 volt buses, so that by means of its main generator switch and its two selector switches any generator may be connected to either bus. The generator connector buses and main generator buses are located on the basement floor. The station is designed so that any generator or any outgoing feeder may be connected to either or both buses.

In the connections between the generator and feeder buses series transformers are placed so as to measure the total output to the substations. As shown on the diagram between the bus and each generator and also between the bus and each feeder there are two switches in series. This is made possible in the case of the feeders without the use of an excessively large number of oil switches by the adoption of the group bus system.

All 13,000 volt oil switches, bus and connections are enclosed in a concrete structure with concrete barriers between the different phases. These structures are unusually large for 13,000 volt structures and look somewhat like monuments. Originally we had planned to build structures on more conventional lines with two rows of bus structures on the basement floor and two rows of switches on the first floor, but after the steel had been erected and the building was well along, a contract was closed with the Great Western Power Co. which necessitated provision for additional oil switches. With the original plan there was just room enough for 12 generator and 12 feeder switches, so it was necessary to make a radical change and the present structure is the result, but not however, without the loss of some sleep.

The Great Western Power Company has installed temporarily on the No. 4 turbo-generator foundation a General Electric 2500 kw. frequency changer consisting of an 11,000 volt, 60 cycle synchronous motor, direct-connected to a 13,200 volt, 25 cycle generator. Its oil switches and switchboard for its 25-cycle end and for its exciter will occupy temporarily the space intended for No. 4 generator panels. A zero center scale curve-drawing wattmeter is installed to show the output from, or the input to, the 25-cycle end.

The local substation bus is located in the basement near the main generator buses. By means of two selector switches it may be connected to either main feeder bus. The outgoing 13,200 volt distribution system consists of four feeders, two of which run north through Oakland to the West Oakland substation and the other two south through Alameda to the same substation. The north, or Oakland, feeders run in conduit from the feeder bus to an outlet tower near the Fruitvale passenger station and from there run overhead

to Lake Merritt where they again go underground and run under First Street to the West Oakland substation. The south, or Alameda, feeders run to an underground switching chamber, thence by submarine cables under the estuary to a switching tower on the Alameda side, and from there overhead through Alameda and across the big towers to a point within 100 ft. of the West Oakland substation where they go underground to the substation.

As shown on the 13,200 volt wiring diagram the two Oakland feeders and the two Berkeley feeders are connected to the two center sections of the "ring bus" at the West Oakland substation, thus permitting the use of one or both of the Oakland feeders in connection with the Berkeley feeders as individual feeders for the Berkeley substation, if desired. At both substations the two Berkeley feeders can be connected together by means of the disconnecting switches, thus permitting the operation of both feeders on either oil switch or of either feeder on the other feeder's oil switch.

Provision has been made for a future high-tension transformer house located at the east end of the power station.

All 13,200 volt circuits are controlled by electrically operated Kelman oil switches. The generator, generator selector and feeder selector switches are non-automatic, while the outgoing feeder and rotary converter feeder switches are automatic.

Excitation System.

Each turbine is provided with a 125 kw., 250 volt exciter mounted on an extension of the main shaft. Each exciter has sufficient capacity to excite at least two turbines under any probable conditions of overload.

Besides the 125 kw. exciters mounted on the extension of the turbo-generator shafts, a 125 kw. General Electric steam-turbine-driven exciter is installed. On the excitation system is installed a 136-cell storage battery with a one hour capacity of 280 amp. It is charged from either of the two 250 volt buses by means of a motor-driven, 90 volt shunt booster. At present 15 plates are installed in a 27-plate lead-lined tank with provision for an increase to 23 plates, or an ultimate capacity of 440 amp. for one hour. Sixteen of the cells are end cells and are controlled by means of an electrically operated end-cell switch. The battery and the end-cell switch were furnished by the Electric Storage Battery Company.

The booster is so connected that in case the exciter from which the battery is being charged becomes disabled and the battery begins to discharge through the booster, the reversal of the current operates a reverse current relay, which throws in an electrically operated switch which shorts the booster and trips the booster breaker, thereby leaving the battery (without booster) on the excitation bus.

Substation.

The local substation is placed in an extension of the turbine room. The present installation consists of three General Electric 1500 kw. 1200 volt rotary units and transformers. Space is left for three additional units. A rotary unit is two 750 kw. 600 volt rotaries, connected permanently in series on the d. c. end, mounted on a common base and with shafts carried in a common center bearing but free to revolve independently of each other. Power is supplied by one General Electric 1500 kw. three to six-phase transformer with a double secondary winding per unit.

The transformers are the forced-oil, water-cooled type, 13,200 volts to 440 volts. They are located in a fireproof room in the basement. Removal of a reinforced concrete hatch above any transformer permits the crane to reach the transformer.

The water for cooling the transformers is taken from the tank on the roof, which is kept filled by the two deep well pumps or from the city mains. After passing through the copper cooling coils the water is discharged into the hot well, not with a view to the utilization of the negligible heat absorbed from the transformers, but to save water.

To facilitate handling, storing and treating transformer and oil switch oil and for filling and emptying transformers and oil switches, an oil system is installed in a chamber outside and at the southeast corner of the building. This room contains one clean and one dirty oil tank, each of 1800 gallon capacity, a motor driven centrifugal pump and an oil filter. Later on, we will probably install a hydrating outfit of some kind. The different tanks and pumps are connected with the transformer by pipes for handling the oil. Normally the exhaust line valve will be so set that in case of fire in a transformer the transformer valve can be opened and the oil discharged into a sump between the building and the canal.

Each transformer is equipped with a thermometer with a contact to ring a bell when the temperature reaches 55 degrees C., and also oil and water flow indicating devices with contacts to ring a bell when either stops flowing.

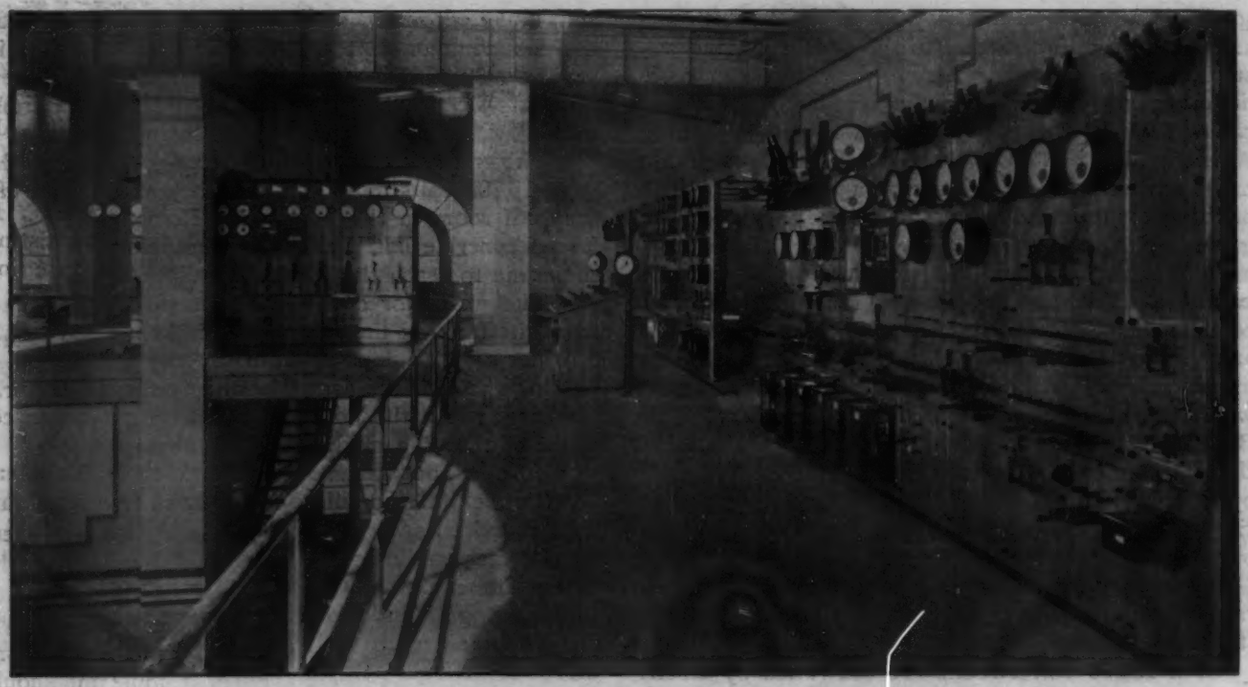
The rotaries are started from the a. c. end from one-third and two-third voltage taps on the transformers, through triple-pole, double-throw General Electric K-3 oil switches. The 440-volt switches are the triple-pole, single-throw General Electric K-2 oil switches. The operating handles of these switches, together with the field break-up switches, negative and equalizer switches and polarity indicators, are mounted on slate panels, mounted on the rotary bases.

The cast-iron rotary bases are mounted on oak insulating frames and, to limit insulation strains and to protect operators, the bases are connected through a resistance of 10 ohms to the 600 volt inter-connection between the two halves of the unit. Additional protection is afforded the operator by the installation of tile insulating floor in the substation.

The efficiencies of transformers and rotaries obtained under test were as follows:

		Transformer.	Rotary.	Combined.
¼	Load	97.6	87.5	85.4
½	"	98.2	92.75	91.
¾	"	98.1	94.5	92.7
Full	"	97.9	95.5	93.6
1¼	"	97.6	96.	93.7
1½	"	....	96.25	....

The maximum temperature rise on the rotaries under full load test was 26 degrees C. on one commutator so the rotaries will safely carry a load of 2250 kw.



Switchboard of Fruitvale Power House.

One of these rotaries has carried 4000 kw. for short intervals without injurious sparking.

During the acceptance tests on the turbo-generators, the three rotaries were loaded on the tidal canal and carried as high as 8000 kw. for one hour. The negative leads were connected to a large steel plate lying on the bottom of the canal. The five 1200 feeders were each connected to a positive plate about 60 ft. from the negative plate. These positive plates were of various shapes and dimensions but the three most satisfactory plates consisted of 8 in. wrought iron pipe about 5 ft. long. The load was varied by cutting in or out feeders and by raising or lowering the positive plates. As a further means of controlling the load a 33 ft. track rail was immersed in the water and suspended from a raft, which was anchored between the positive and negative plates or below the negative plate, depending upon the load requirements.

We found that the height of the tide greatly affected the amount of load obtainable. At low tide only 5000 kw., while at high tide 8000 kw. load could be obtained.

Switchboard.

The switchboard is placed on a gallery at the east end of the turbine room extension. The power station board is of standard construction designed in three sections, i. e., benchboard, generator and feeder instrument boards and exciter and auxiliary d. c. boards. The generator rheostats and speed-changing devices are motor-operated from the benchboard. A totalizing panel is provided for metering the total output of the generating station by means of curve-drawing watt, volt and frequency meters.

The substation 1200 volt board is installed at right angles to and near the power station board. Double-panel construction is used, with the front and the rear panels 4 ft. apart. All switches and circuit breakers are the remote-control hand-operating type. The front panels contain the instruments and switch-operating levers. The switches and circuit-breakers are mounted on the rear panels. Spare rotary and spare feeder breakers are provided, with their switches connected to the spare breaker buses mechanically interlocked so that only one rotary or feeder at a time can be connected to its respective spare breaker bus. While the angle-iron frames of the front and rear panels are insulated from ground and from each other, the station will be operated with the front frame grounded and the rear frame insulated. Soapstone slabs placed across the top between the front and the rear panels form a floor for support of the rheostats and make the rheostats, 1200 volt bus and breakers easily accessible.

The 1200 volt bus is carried in a fireproof compartment above the soapstone slabs. The rotary rheostats are mounted on the soapstone slabs above the panels. A Thompson watt-hour meter and a Westinghouse graphic recording wattmeter are installed to measure the total output of the substation. The entire switchboard was furnished by the Westinghouse Electric & Manufacturing Company.

Two 30 kw., 13,200-2300 volt Allis-Chalmers transformers furnish 25-cycle current for the operation of the local block signal system.

The station is lighted from the 250 volt excitation bus, across which a balancer set is connected to produce a three-wire system. For emergency use taps brought out from the middle cells of the storage battery are connected to a 9-point end-cell switch. The turbine and the boiler rooms are lighted by General Electric 6.5 amp. luminous arc lamps suspended from the steel work. For other lighting around the generating station building individual 16-c.p. lamps are generally installed.

The conduit, lighting, rotaries, transformers, oil switches, switchboards and wiring and cable, in fact all electrical apparatus except generators and the stor-

age battery, were installed by the company forces.

In addition to the electrical design, the installation of all electrical apparatus came under the supervision of the speaker. To F. E. Manzer, construction foreman, credit is due to the fine appearance of the cable and switchboard installation.

A. H. Babcock: The hour is getting late, but I want to give you just a brief summary of the tests of the plant up to date, and then we will start the number one turbine, and from that start the rotaries, so you can see how easily the station is handled.

At the ordinary average load of the plant, the guarantees on the boilers were 14 lb., and the performance was 16 lb.; the turbo-generator consumption on the same load was guaranteed 16.37 lb., and the performance is 15.77 lb.; the condensers were guaranteed to give 28 in. vacuum and they have given us 28½ under the extreme load condition.

The generators as I said before are within their heating limit at 7500 kw., steady load; and these rotary units are within their heating limits at 2250 kw.

It is so late now that I cannot call upon others who I know would like to say something, especially from the manufacturers' standpoint; but they will understand.

The meeting then adjourned for a general inspection of the plant.

BOOK REVIEWS.

Good Engineering Literature. By Harwood Frost. 422 pages, 5x7½ in. For sale by Chicago Book Co., 226 So. La Salle St., Chicago, and Technical Book Shop, 604 Mission St., San Francisco. Price $1.00.

The purpose of this book is clearly expressed in its sub-title, "What to read and how to write, with suggestive information on allied topics." To this task the author has brought an experience and training which eminently qualifies him to act as mentor to his less-informed brethren. In twenty-two logical chapters he gives the engineer valuable information on the design and construction of a literary production. Details as to the choice and proper arrangement of materials, in this case words and sentences, are emphasized, while those relating to mechanical construction of a periodical or book are briefly summarized. Special stress is laid upon the means of protecting and marketing the author's work. The concluding chapters show how the value of the engineer's library may be enhanced by proper indexing and filing and careful selection. This volume is more comprehensive than the usual "style sheet"; it admirably fills a long-existent void and is earnestly commended to those engineers who have something to say but lack proper means of expression.

The Principles of Scientific Management. By F. W. Taylor. 144 pages, 6x9 in. Published by Harper & Bros., New York, and for sale by Technical Book Shop, San Francisco. Price $1.50.

Herein are discussed the reasons and remedies for the prevalent inefficiency of human labor. The author has devoted years of study to this problem and cites many instances where it has been successfully solved by applying the principles of task management. This consists in giving each workman a carefully planned task for performance each day, supervising its performance and paying higher wages. It means the substitution of science for rule of thumb, co-operation for individualism, maximum output for restricted output and the development of each man to his greatest efficiency and prosperity. It places the responsibility on the manager rather than the workman and redounds to the benefit of both. While the system is not universally applicable, this book is pregnant with suggestions to every man handling manual laborers. It treats of a new and important subject in an interesting and instructive manner and is a valuable contribution to the industrial world.

Wireless Telegraph Construction for Amateurs. By A. P. Morgan. 188 pages, 5⅛x8 in. 147 illustrations. Published by D. Van Nostrand Co., New York, and for sale by Technical Book Shop, San Francisco. Price $1.50.

The object of this book is to enable any intelligent boy to construct and operate a wireless telegraph outfit. After a simple explanation of the theory of electric wave generation, transmission and reception, the author gives a detailed description of the apparatus for receiving and sending messages by the spark system. The treatment is replete with practical directions for constructing the essential parts at home and should be of great value to the tyro. Most of the information has already been published in other places, but is here assembled in compact and convenient form. While of little use to anyone who has already constructed a station, it is an admirable treatise for a beginner.

Power. By Charles E. Lucke. 316 pages, 5½x8 in. 223 illustrations. Published by The Columbia University Press of New York City, and for sale by Technical Book Shop, San Francisco. Price $2.00.

This volume comprises a series of lectures given by Professor Lucke to the students of Columbia University. In the first two chapters in a most readable style the author traces the evolution of mechanical power to the present types of machinery. Succeeding chapters are devoted to steam power, gas power and water power, in each case giving a simplified account of the principles and their application. Little or no mathematics is employed, so that the text forms an excellent introduction to more detailed study. It deals with generalities rather than specific details which are employed merely to illustrate the principles developed. It should be of especial value to the layman desirous of knowledge on this subject and to the specialist wishing a birds-eye view of approved practice in other fields. It may be briefly characterized as a history of power development.

Water power sites are taxable, according to a decision of the State tax commission of Washington. The ruling was made in answer to an inquiry by the assessor of Klickatat County. The decision follows in part: "The law reqires the assessment of all property at its full and fair value in money. A water power is not assessed as a water power, but 160 acres of land which has upon it a very desirable and valuable water power and which makes that 160 acres of land worth from four to 40 times as much as the adjoining 160 acres of land, should be assessed at from four to 40 times higher than the adjoining 160 acres."

THE APPLICATION OF ELECTRIC POWER TO LOGGING.

BY E. G. ROBINSON JR.

The application of electric power to logging operations involves not only an electric driven yarder but also an electrically operated logging road. In the first instance the donkey engine is replaced by an electric motor while in the second instance an electric locomotive is substituted for the usual Shay engine.

A yarder is used to haul the logs from their fallen position to the railroad spur. No skid-road is built nor is there any clearing done, the log being pulled with main force and awkwardness and often butting against a stump or burrowing through a mound of earth. The rigging must be sturdy and the donkey must possess vast flexibility as to speed of cable and developed power.

Frequently a log will be bound between stumps or behind other logs, thus requiring a slow and powerful pull to dislodge it. Though the speed of the cable must be slow, the actual work done is great, as when a log comes to a dead stop on account of some obstruction the cable will often stretch 15 ft. To stretch an 1¼ in. cable 15 ft. means a tremendous pull. Such are the conditions that an electric donkey must meet with the same speed, the same strength and the same effectiveness as is now being accomplished by steam. The electric rig must meet every demand that the steam donkey is called upon to perform, and must do it without trouble and without hesitation.

The most feasible plan for the change is to remove the boilers and engines that are now on the present donkeys and place the motor thereon, replacing the crank disks with sprockets for a double chain drive. In placing a motor on a donkey equipped with a steam friction brake a small automatic motor driven air compressor can be installed with a storage tank and the advantages of this control can thus be retained. A donkey is worked only about one-third of the time, and so with five or six donkeys on the line the resultant peak load would not exceed 60 per cent of the sum of the peaks.

On account of the continual demand for a slow speed and heavy duty, or a large amount of power slowly applied, the writer has designed a semi-automatic variable speed gear, so that on starting a heavy load or wanting to make a slow steady pull it will give the motor a tremendous mechanical advantage. This gear ratio can be changed without a jerk and without slacking the cable or interfering with the progress of the log. The ratio can be either increased or decreased as desired within the limits of the gears. Probably with reference to the crank disks only these gears would be 3 to 1 or 2 to 1, and assuming a gear ratio of 6 to 1 from disc shaft to the heavy duty cable, this would give a maximum gear ratio of 18 to 1 an intermediate of 12 to 1 and a straight ratio of 6 to 1. These several positions are under the direct control of the donkey engineer. This variable speed gear applied to an electric donkey will cut down considerably the severe peaks that would occur on starting the donkey under heavy load. The motor would be also protected by a time limit relay so that the supply of current could be cut off at a predetermined quantity and also that the cable would not be broken when the log was immovable.

The motor capacity of an electric locomotive need not be excessive for the tonnage it will be called upon to handle. It can be comparatively small as to the service that is required on roads where the mileage per hour is high and the item of rapid acceleration of trains is essential. The maximum speed need be only from 15 to 20 miles per hour, so with comparatively small motors properly geared all desired results can be easily attained. The locomotive could be run on the main road with 6600 volts single phase, 12½ to 15 cycles, the motor to be standard series with step down transformer on the car and with standard controllers. A catenary construction is not necessary, as the speeds are low and ample insulation can be obtained with special heavy properly designed hangers. The trolley need be only a cheap, strong and insulated trolley. The locomotive also would be arranged so that the transformers on car could be automatically cut out close to the woods as the trolley line voltage would be the voltage of the donkey motors and also of the locomotive motors. The reducing of the trolley voltage here would eliminate the hazard of the high tension trolley close to the workings. The trolley could be tapped at any point for a power supply to the donkey.

One company using four donkeys, a 600-ton road engine and a smaller switching engine, all burning coal has an annual fuel bill of $19,374.54, about 39 cents per 1000 for the logs delivered to the boom. The writer believes that with the electric locomotive that the switching engine could be dispensed with as there would be no water or fuel to be delivered in the workings and no coal or fuel to be handled in the main line. There would be only one man necessary on the locomotive. This company is also pumping water from a near-by creek to a large storage tank at the camp whence the water is transferred to a tank on trucks to be delivered to the several donkeys. This pumping requires the services of one man, a boiler and pump, this having to be run 6 days a week.

In some places furnishing the donkeys with water is a very expensive item. With steam it takes two men to run the donkey, one fireman from $2.50 to $3 per day and one engineer from $3.50 to $4.00 per day, this granting that the fuel is coal or oil, and I believe either is cheaper than wood.

Where wood is burned it takes an extra man to saw the wood. The wood used is also an important item as only good sound logs suffice. Reliable data shows that it costs about $17.00 per day to run the largest donkeys using wood as fuel. This includes all labor and fuel. The freezing of water pipes in winter is a serious problem and often on starting the donkey in the morning the engineer finds that his lubricator is cracked or that his injector is broken. We all know that these things will happen with the best of night watchmen.

A man to run these motors need not be an electrician any more than the motorman on an electric car. One good lineman and a couple of helpers would be able to keep things going after once installed. A couple of new armatures could be carried in stock and could be quickly installed in case of a burn out, and the old one sent to some electric repair shop to be repaired. The variable speed gear will be built with removable sections of steel gears that can be easily and quickly

repaired should a gear be stripped or broken. Also by making the bearings of the pinion that meshes with the cone gear adjustable, a uniformly different gear rate could be secured in localities when it might be found advisable.

Though the advantages of electric logging are obvious in many respects, it might be well to make a brief summary of some of the chief points.

First and most prominent is the absence of any source of fire either from donkey or locomotive.

Second: Economy of operation. Power can be purchased from a transmission company cheaper than it can be generated with steam in many units and granting that a logging company had to install its own steam plant it would be vastly cheaper to operate one large steam plant than several small ones, especially as the collective peak load on several donkeys would not exceed 60 per cent of their individual peaks multiplied by the number of donkeys. It therefore follows that the station capacity need only be 60 per cent as large as the sum of the separate steam plants. This same steam plant could also be advantageously located as to boiler, water and fuel. It could also be run condensing and with high efficiency boilers and engines the fuel consumption could be greatly reduced.

Third: On threatening mornings instead of sending out the full crew of firemen to raise steam and wait for the weather to either get worse or improve, with the electric rig only one steam plant need be in readiness and the shaking up of one fire as the crew starts to work will have all in readiness in a brief period.

Fourth: Not having to secure water for the donkeys which is difficult and expensive in summer, while in winter there is the continual annoyance of freezing.

Fifth: One man will run a donkey, doing away with the fireman and if wood is used as fuel, it will dispense with a second man.

Sixth: The distribution of coal and handling of same and the necessary provision for its storage will be eliminated.

In conclusion it might be well to state that any logging company going into this thing should secure the services of a first-class experienced, accredited electrical engineer, as many of the problems are new and experienced and trained judgment is necessary for their proper solution. This engineer must also familiarize himself in detail as to the work in hand. In case a logging company installs its own plant strictly for logging this station equipment will be special as extra fly wheel capacity will be necessary and the generator so designed that its heating will not be excessive for brief heavy overloads.

Electrical logging is to be experimentally demonstrated at the camp of the Ebey Logging Company near Arlington, Wash., during the coming summer. Power for a series of demonstrations will be supplied by the Jim Creek Water, Light & Power Company, while the equipment will be furnished by the Westinghouse Electric & Manufacturing Company. This will consist of motor-driven 11 x 13 Humboldt Willamette yarder with a capacity for 1600 ft. of 1⅛ in. cable and several thousand feet of ⅝ in. haul back line. The motor is to be a 150 h.p. enclosed type M. W. Westinghouse, 440 volt, 3-phase, 60-cycle.

STEAM TABLES.

The accompanying tables are published through the courtesy of Chas. C. Moore & Co., engineers, San Francisco. No. 1 shows the complete plant steam consumption in pounds of steam per kilowatt-hour from 100 to 250 with net boiler efficiencies, including standby losses, of 75 and 80 per cent for both saturated and super-heated steam. These are based on the assumption that there are 18,500 B.t.u. per pound of oil, 336 lb. of oil per barrel, a feed water temperature entering boiler of 180 degrees F., 175 lb. gauge steam pressure at boiler and a specific heat of .57 for superheated steam. The consumption includes steam to the prime mover, auxiliaries, oil burners and all steam losses within the plant.

Assumed K.W. Hrs. per Bbl. of Oil	Saturated Steam		Superheated Steam, 125° F at Boiler	
	Corresponding complete plant steam consumption – pounds steam per K.W. Hr.			
	75% Boiler Eff.	80% Boiler Eff.	75% Boiler Eff.	80% Boiler Eff.
250	17.82	19.01	16.68	17.88
240	18.56	19.80	17.38	18.64
230	19.37	20.66	18.14	19.35
220	20.25	21.60	18.96	20.23
210	21.21	22.63	19.86	21.19
200	22.28	23.76	20.86	22.25
190	23.46	25.01	21.95	23.42
180	24.75	26.40	23.17	24.72
170	26.21	27.95	24.54	26.17
160	27.84	29.70	26.07	27.81
150	29.67	31.68	27.81	29.66
125	35.64	38.02	33.37	35.59
100	44.55	47.52	41.71	44.50

Table No. 1. Complete Plant Steam Consumption.

Diameter of Low Pressure Cylinder	Piston Speed				
	600	700	800	900	1000
24	4.04	4.71	5.38	6.05	6.73
26	4.74	5.53	6.32	7.11	7.90
28	5.49	6.41	7.33	8.24	9.16
30	6.31	7.36	8.41	9.46	10.51
36	9.08	10.60	12.11	13.62	15.14
42	12.36	14.42	16.48	18.54	20.60
48	16.15	18.84	21.53	24.22	26.91
54	20.44	23.84	27.25	30.65	34.06
60	25.23	29.44	33.64	37.84	42.05
66	30.53	35.62	40.71	45.79	50.88
72	36.33	42.39	48.44	54.49	60.55
78	42.64	49.75	56.85	63.96	71.07
84	49.45	57.70	65.94	74.17	82.42
90	56.77	66.24	75.69	85.15	94.61

Table No. 2. Gain in Horsepower per Inch of Vacuum.

Table No. 2 shows the gain in horsepower per inch of vacuum for various cylinder diameter and piston speeds. It is calculated from a theoretical indicator card on the basis that for every inch increase in vacuum there will be an inch increase in mean effective pressure.

HAMMON OWNS MONTEREY PLANT.

W. P. Hammon has taken over the Monterey County Gas & Electric Co., which was bought some months ago in the name of F. G. Baum & Co.

Examination for Electrical Inspector in the San Francisco Department of Electricity will be held in the Commercial School on Grove near Larkin Street, Saturday, June 10, at 1:30 p. m. Applications must be personally filed with the Board of Civil Service Commissioners before 5 p. m. June 8th.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE
Technical Publishing Company
E. B. STRONG, President
A. H. HALLORAN, Vice President and Managing Editor
C. L. CORY, Secretary.
DIRECTORS
R. J. DAVIS A. M. HUNT A. H. HALLORAN C. L. CORY E. B. STRONG
604 MISSION STREET, SAN FRANCISCO

EASTERN OFFICE, 140 NASSAU STREET, NEW YORK

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	5.00
Single Copies, Current Month	each	.25
Single Copies, prior to Current Month	"	.50

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1899.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

The Fruitvale Power Plant 475
- General Features. . . *By A. H. Babcock.*
- Architectural Features. *By D. J. Patterson.*
- Office Engineering. . . *By J. J. Ferrier.*
- Steam Details. . . . . *By J. J. Ferrier.*
- Electrical Details. . . . *By H. Y. Hall.*

Steam Tables 489

Taxing Water Power Sites 487
By E. G. Robinson.

Book Reviews 487
- "Good Engineering Literature."
- "The Principles of Scientific Management."
- "Wireless Telegraph Construction for Amateurs."
- "Power."

The Application of Electric Power to Logging 488

Examination for Electrical Inspection 489

Editorial 490
- Distinctive Features of Fruitvale Power House.

Personals 491

A. I. E. E. Annual Meeting 491

Patents 492
- Continuous Internal Combustion Generator.
- Oil Burner.
- Process of Impregnating Wood.
- Apparatus for Obtaining Nitrogen from Air.
- Automatic Control for Hydraulic Nozzles.

Industrial 493
- New Type of Oil Break Switch.
- Kellogg New Testing Cabinet.
- The Traveler's Electric Iron.

Trade Notes 494

New Catalogues 494

Meeting of Pacific Northwest Society of Engineers 494

News Notes 495

Distinctive Features of Fruitvale Power House

Power plant practice on the Pacific Coast has long been distinguished by a plainness of finish, an absence of architectural pretense, the utility of every detail for the immediate object in view, but, as a rule, a total lack of the esthetic. This seems to hold not only in plants situated in remote places but also within the cities. The practical engineer and operator seldom cares for the apparently useless expense of artistic appearance. This attitude is undoubtedly shortsighted and erroneous, but the beneficial results of artistic environment and finish are happily becoming better understood. The Fruitvale power house of the Southern Pacific Company is unique in this respect and should serve as a far-reaching example of the possibilities of inexpensive but effective treatment of form and finish, adding to the city a quasi-public building which will enhance the general appearance of the district, rather than introduce an eye-sore of the so-called mill or factory type. Symmetry in outline and harmony in coloring has been consistently followed in both the interior and the exterior. Such interior finish goes a long way towards creating an incentive for cleanliness, and this in turn is one of the greatest inducements to an interest in their work on the part of the men operating the plant.

Another feature noteworthy to the engineer and those interested in construction work is the system employed in the design and erection of this plant, enabling the work to proceed like a well-operated train schedule. To build such a plant without a mistake in fabrication, without unforseen delays or a change from the complete drawings is most remarkable. Unfortunately it is often difficult to convince owners that a system of fine detail as used here is either essential or worthy of the expense and time. In justice, however, to many plants which cannot boast of such ideal construction, a much longer period was allowed for the study of design and detail than is usually possible. In fact, most of our plants have been constructed under terrific pressure, where time is the principal element to be sacrificed to obtain service.

The electrical features of the system adopted at the Fruitvale plant are interesting in their conservatism. The problem presented is in no wise different from other tide-water plants which are to generate power to be distributed to all parts of a direct current railway network. The choice of converting apparatus, if it be rotary converters, determines the use of a low frequency for high tension distribution, but complicates the system if any dependence is to be made on local supply in case of emergency, where this supply operates at a higher frequency.

Here alternating current is generated at 25 cycles and is distributed to be converted to direct current by means of rotary converters. In view of the fact that 60 cycles has become a standard in this district and that the plant has been equipped to receive an auxiliary at this frequency, necessitating extra machinery in the form of frequency changers, the question arises as to the advisability of using this extra apparatus and generating at low frequency rather than at the prevailing frequency and converting to direct current through motor-generators.

PERSONALS.

H. W. Baum, an engineer of Denver, was a recent San Francisco visitor.

N. Ellery, the state engineer of California, with headquarters at Sacramento, is at San Francisco.

F. J. Somers, manager of Century Electric Company of San Jose, visited San Francisco during the past week.

W. G. Vincent Jr. is working with J. G. White & Co. on an appraisal of the properties of the Pacific Gas & Electric Co.

Arthur Caldwell, general manager of the California Electrical Construction Company of San Jose, recently visited San Francisco.

A. G. Wishon, general manager of the San Joaquin Light and Power Corporation, arrived at San Francisco from Fresno last Tuesday.

M. H. Dickinson, an engineer connected with steam and electric power interests at Seattle, was at San Francisco during the past week.

Hugh McPhee, district traffic superintendent of the Western Union Telegraph Company, with headquarters at Los Angeles, is at San Francisco.

Rudolph W. Van Norden has returned to San Francisco after inspecting the new Coleman plant of the Northern California Power Company which he designed.

A. A. Serva, sales manager of the Fort Wayne Electric Works, has returned to San Francisco from the Yosemite Valley and will return East by way of Portland and Seattle.

George Bell, formerly with the Westinghouse Electric & Manufacturing Company, has become associated with the Duncan Electric Manufacturing Company of Lafayette, Indiana, as sales manager.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, returned last Tuesday from a trip to the Hawaiian Islands. He used his own automobile on the Island roads.

H. H. Noble, president of the Northern California Power Company, returned last Wednesday from a trip to the new Coleman hydroelectric plant, which is expected to start up during the summer with a capacity of 20,000 h.p.

A party of engineers, representing J. W. and W. S. Kuhn, who are engaged in a great reclamation project in the Sacramento Valley region, recently visited San Francisco in search of engineering data. P. S. Bicknell, chief engineer of the Twin Falls Land and Water Company, and I. B. Perrine, also of Twin Falls, Idaho, were among the number.

T. W. Carroll, assistant to the general manager of the Western Union Telegraph Company, spent a few days at San Francisco and left last Wednesday for an inspection of the system in the Pacific Northwest in company with C. H. Gaunt, general superintendent of the Pacific Division. He reported conditions generally favorable throughout his Western tour.

A. I. E. E. ANNUAL CONVENTION.

The annual convention of the American Institute of Electrical Engineers will be held in Chicago, Ill., June 26-30. The official headquarters will be at the Hotel Sherman, corner of Clark and Randolph streets, where the technical sessions will also be held. The following program has been arranged:

TUESDAY, JUNE 27.

Power Station Session.

10 A. M.

President's Address, by Dugald C. Jackson.

Address by President-Elect, Gano Dunn.

"Development of the Modern Central Station," by C. P. Steinmetz.

"Tests of Oil Circuit Breakers," by E. B. Merriam.

"The Use of Reactance Coils in Large Central Station Systems," by R. F. Schuchardt and E. O. Schweitzer.

Visit to Western Electric and Commonwealth Edison Companies' plants.

Electric Lighting Session.

"Depreciation as Related to Electrical Properties," by Henry Floy.

"Important Features Entering Into Making of Appraisals," by H. M. Byllesby.

WEDNESDAY, JUNE 28.

Railway Session.

"Some Data From the Operation of the Electrified Portion of the West Jersey & Seashore Railroad," by B. F. Wood.

"Analysis of Electrification," by W. S. Murray.

"Solution of Problems in Sags and Spans," by W. L. R. Robertson.

"Induction Machines for Heavy Single-Phase Motor Service," by E. F. W. Alexanderson.

Industrial Power Session.

"Automatic Motor Control for Direct-Current Motors," by Arthur C. Eastwood.

"Some Limitations of Rheostat Control," by T. E. Barnum.

"Control of High Speed Electric Elevators," by L. L. Tatum.

"Electrically Driven Reversing Rolling Mills," by Wilfred Sykes.

"Electric Vehicles," by P. D. Wagoner.

Parallel Meeting.

Telegraphy and Telephony Session.

2:30 P. M.

"Multiplex Telephony and Telegraphy by Means of Electric Waves Guided by Wires," by George O. Squier.

"Telegraph Transmission," by F. F. Fowle.

"Commercial Loading of Telephone Circuits in the Bell System," by B. Gherardi.

THURSDAY, JUNE 29.

High Tension Transmission Session.

"The Law of Corona and the Dielectric Strength of Air," by F. W. Peek, Jr.

"Mechanical and Electrical Characteristics of Transmission Lines," by Harold Pender and H. F. Thomson.

"Dielectric Strength of Air," by J. B. Whitehead.

"Sag Calculations for Suspended Wires," by P. H. Thomas.

"Transmission System of the Great Western Power Company," by J. P. Jollyman.

"Transmission System of Southern Power Company," by W. S. Lee.

"Transmission System of the Great Falls Power Company," by M. Hibgen.

"The High Efficiency Suspension Insulator," by A. O. Austin.

"Electric Line Oscillations," by G. Faccioli.

FRIDAY, JUNE 30.

General Session.

10 A. M.

"Economical Design of Direct-Current Electro-Magnets," by R. Wikander.

"Electrolytic Corrosion in Reinforced Concrete," by C. E. Magnusson and G. H. Smith.

"Wave Shape of Currents in an Individual Rotor Conductor," by H. Weichsel.

"The Choice of Rotor Diameter and Performance of Polyphase Induction Motors," by Theodore Hoock.

"The Application of Current Transformers in Three-Phase Circuits," by J. R. Craighead.

"The Cost of Transformer Losses," by R. W. Atkinson and E. C. Stone.

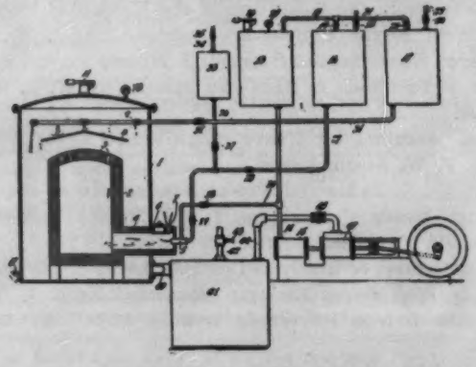
Educational Session.

"Tentative Scheme of Organization and Administration of a State University," by Ralph D. Mershon.

"Technical Education: Its Correlation with the Industries," by John Price Jackson.

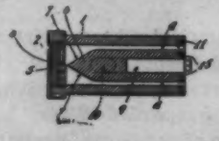
PATENTS

992,891. Continuous Internal-Combustion Generator. John D. Loop, Pomona, Cal. An internal combustion pressure generator comprising a casing forming an outer chamber, a shell of refractory material forming a combustion chamber within said outer chamber, said shell being spaced apart from the casing of the outer chamber and forming a space therebetween,



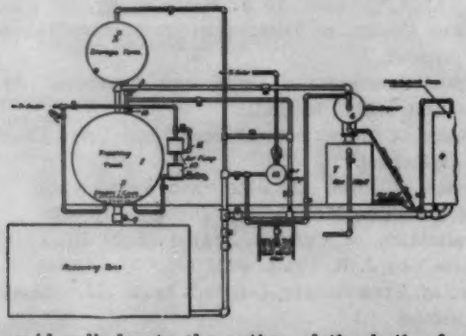
a burner provided with means for injecting oil and supplying air under pressure to the combustion chamber, a spreader plate above said combustion chamber extending beyond the shell thereof, means for supplying water to the outer chamber above the spreader plate, and means for drawing off the resultant gases under pressure from the outer chamber.

992,924. Oil-Burner. William H. Kelly, Los Angeles, Cal., and Silas B. Tainter, Seattle, Wash. A burner comprising a body having a central passage for elastic fluid and having an oil inlet at its rear end and provided with oil passage means extending forwardly from said oil inlet to the front of the



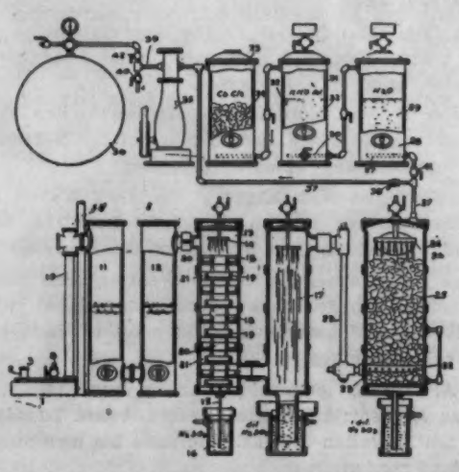
burner body, said oil passage means embracing the aforesaid central passage, and tip plate means detachably fastened to the front end of the burner body and provided with orifices communicating with the aforesaid passage for elastic fluid and with the passage means for oil.

992,918. Process of Impregnating Wood. Charles Stowell Smith, Berkeley, Cal. (Dedicated to the public). The herein described process of preserving wood which consists in introducing the wood into an air tight cylinder, subjecting the



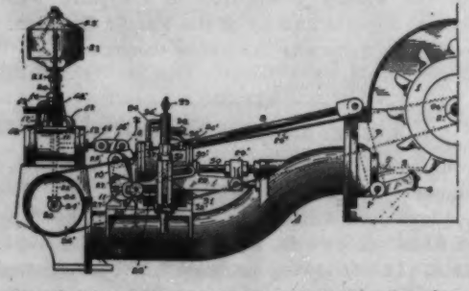
wood in said cylinder to the action of the bath of oil at approximately 220 degrees F. for a length of time sufficient to heat up the wood and thereby vaporize most of the water contained in the wood, then drawing off the oil and applying an air pressure of about 50 pounds per square inch, introducing a preservative oil at approximately 120 degrees F. and raising the pressure to about 157 pounds per square inch, for a length of time sufficient to insure the desired impregnation, then relieving the pressure and simultaneously drawing off the unabsorbed oil and then subjecting the wood to a vacuum for the purpose of drawing out a portion of the oil from the cell cavities.

992,017. Apparatus for Obtaining Nitrogen From Air. Charles Blagburn, San Francisco, Cal. An apparatus for obtaining nitrogen from atmospheric air consisting of a furnace of considerable area in proportion to its height to expose a large body of sulfur to oxidation and so concentrated as to



compel the whole of the air supplied to said sulfur to flow into contact with the sulfur in the furnace, means for supplying sulfur and air at one and of said furnace, a conduit at the other end of said furnace for the resulting gases, means for removing from said gases the sublimated sulfur, means for washing from said gases the sulfurous acid, and means for confining the residual nitrogen, substantially as described.

993,064. Automatic Control for Hydraulic Nozzles. George J Henry, Jr., San Francisco, Cal., assignor of one-half to The Pelton Water Wheel Company. In combination with a water wheel, a rigid nozzle, a needle valve therein for controlling the outlet orifice thereof, and a deflecting hood arranged to swing in advance of the nozzle for the purpose set forth, of



a motor for the hood, a governor actuated valve for controlling the motor, connections between the motor and hood, a motor for the needle valve, a valve for the motor, means actuated by the aforesaid connections for shifting said motor valve, said means being connected to the needle valve and comprising provision for restoring said valve to normal position and bringing the needle valve to rest, as set forth.

INDUSTRIAL

NEW TYPE OF OIL BREAK SWITCH.

A new type of oil break switch has lately been placed on the market by the General Electric Company for use on circuits where the potential does not exceed 15,000 volts. A straight line operating mechanism is employed, which, with the exception of the operating lever and its connecting link, is entirely mounted upon the switch frame. This mechanism gives a vertical parallel movement to the movable contact blades and both obviate the danger of friction or binding and increases the speed of the switch break. This mechanism is adjusted at the factory and requires no further adjustment.

The fixed contacts are of the well-known drop forged copper, flared finger type. The movable contacts are wedge shaped copper blades, each provided with a slot in the upper extremity, permitting a jet of oil to be forced into the arc on rupturing the circuit. This assists in extinguishing the arc quickly and reduces the disturbance in the oil vessel.

Fig. 2. K-12 300 Ampere Oil Break Switch.

Fig. 1. K-12 Solenoid Operated Oil Break Switch.

This construction, insures clean contact surface and good contact under pressure over the entire surface and also prevents burning and pitting the contact surfaces, inasmuch as the arc is not ruptured between the actual contact surfaces but between the upper extremity of the moving contact and the flared portion of the stationary contact.

The insulators are of one-piece glazed porcelain of the highest grade, corrugated to give large creepage surface. Each insulator extends below the oil level and is clamped to the frame by two metal plates and four cap screws, eliminating the use of babbitt or cement. The insulators are interchangeable.

The switch being a self-contained unit is conveniently handled and installed without interfering with the alignment. The arrangement of terminals employed saves time and labor in installing or disconnecting.

In the form K-12 oil break switch, greater striking, and arc-over distances, greater oil and greater air spaces are secured. The type F form K-12 oil break switches are made single, double, triple and four-pole for mounting on panel, on panel pipe supports, on frame work remote from panel, or in masonry cells.

They can be supplied either hand or solenoid. The automatic switches can be arranged to operate on low voltage, reverse current and the like. Bulletin 4821 gives a complete description of the switch.

KELLOGG NEW TESTING CABINET.

The testing cabinet illustrated herewith has been designed for use in connection with small exchanges. It affords a means for making reliable tests of trouble that arises in equipment of this type. Practically the same tests can be made with this cabinet as with our more elaborate wire chief's desk.

The cabinet containing the apparatus in the testing circuit is 13½ in. high, 10 in. wide, and 6 in. deep and is substantially made of quarter-sawed oak and gives a golden oak finish. A Weston round pattern voltmeter is mounted in the front directly above the keys. Two connectors are located below the keys for connecting to a Wheatstone bridge.

The advantage of a compact testing cabinet of this type is, that it may be mounted on the end of the switchboard section within easy reach of the subscriber's line equipment.

Kellogg Testing Cabinet.

Tests which can be made with the testing cabinet are as follows: Location of grounds on a subscriber's line, short circuits, crosses between two subscribers' lines, foreign currents, opens, cross talk, earth currents, insulation, swinging, grounds, receiver off of hook, resistance of drop coils, receivers, etc., voltage of dry or storage cells.

A set of instructions is furnished with each testing cabinet which fully describes the method of making tests.

The apparatus included in the test panel consists of: A Weston No. 24 round pattern flush type voltmeter scale 0-50 volts with a 10,000 ohm coil, and the necessary keys for making the tests previously outlined. The operator's telephone consists of a desk stand complete with operator's receiver, head band, cord and induction coil. If desired, a

breast plate operator's set instead of that described above, will be furnished.

A flexible two-conductor testing cord, and a single conductor grounding cord is provided, if the testing set is for a Kellogg switchboard and if ordered otherwise, the set will be shipped without cords. Each of Kellogg cords will be eight feet in length. With this testing cord attached to a switchboard plug, it is possible to reach any subscriber's line equipment in a three-position switchboard.

If it is desirable to locate the testing cabinet in the terminal room it is only necessary to connect the cord connectors of the testing cabinet with the cord fasteners of any vacant cord in the switchboard, by means of a twisted pair of wires.

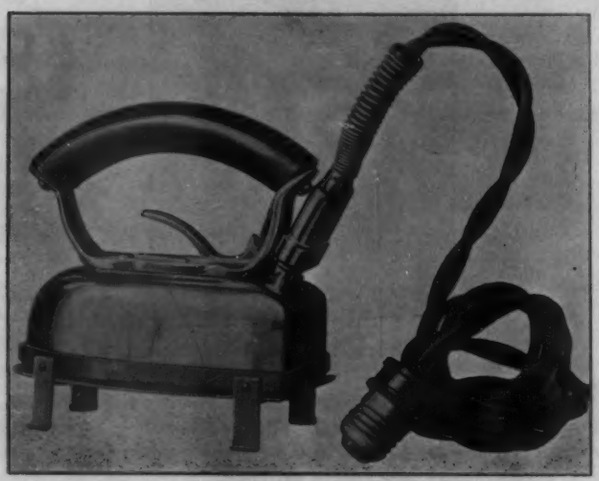
To make tests from the main distributing frame or terminal rack, a twisted pair of wires are connected to the binding posts in the testing cabinet and run to a pair of suitable connectors located near the distributing frame. A flexible four-conductor cord or wires (with an arrester plug attached to one end, if of the heat coil type) are used to complete the connection between the connectors and the arresters on the distributing frame.

With the connections completed as described, it is possible to test either in through the switchboard or out on the line. This cord and plug is not furnished unless called for extra and then only in case the arresters are of our No. 1 make or of some other standard make where the manufacturers of same carry a stock test plug.

THE TRAVELER'S ELECTRIC IRON.

Often the traveler has occasion to do light pressing in his or her room. Creases in garments must be eliminated, the effects of damp weather must be removed and often dainty linen must be pressed. An electric iron is invaluable for these services but, for the traveler, an iron should be so designed that it can be packed readily and it must be thoroughly reliable.

The Westinghouse electric traveler's iron has three qualifications. The handle can be removed so that a minimum of packing space is necessary. The heating element is enclosed, under enormous pressure, between the bottom ironing face and a top casting which constitutes a heat reservoir and which is thermally insulated from the sheet metal cover by an air space. This construction prevents oxidization of the element, hence it will last indefinitely.



Westinghouse Electric Iron for Travelers.

A noteworthy feature of this iron is that no breakable material enters into its construction. Porcelain, lava, or moulded asbestos, all of which are brittle, are sometimes used in electric irons, or in the connecting plugs. None of these materials is used in the Westinghouse iron or in its plug. All insulation is of sheet mica and the connecting plug is composed wholly of metal and sheet mica.

A hole is provided in the end of the iron, in which a curling iron can be heated. A durable stand, formed from sheet metal, is furnished with each outfit.

TRADE NOTES.

F. C. Finkle, consulting engineer, announces the removal of his offices from 628½ South Spring Street to 448-9 J. W. Hellman Bldg., Los Angeles, Cal.

R. J. Davis, Pacific Coast representative, Century Electric Company of St. Louis, Mo., has opened an office at Los Angeles, 220 Lissner Bldg., in charge of P. A. Shelton.

On June 1, 1911, the Fort Wayne Electric Works will be merged with the General Electric Company of Schenectady, N. Y. Its business will be conducted under the name of Fort Wayne Electric Works of General Electric Company. The same lines of apparatus and supplies will continue to be manufactured and sold under the immediate direction of the same individuals as heretofore, with Mr. F. S. Hunting in responsible charge as general manager. The branch office of the Fort Wayne Electric Works of General Electric Company will be continued as heretofore.

NEW CATALOGUES.

Direct Current Grinders and Buffers for machine shop use are illustrated and described in Bulletin No.1127 from the Fort Wayne Electric Works.

Bulletin No. 1128 from the Fort Wayne Electric Works is devoted to Multiphase Induction Motors with either riveted or skeleton frames for all services.

Type K 3 Multiphase Induction Watthour Meters are illustrated and described in Bulletin No. 1129 from the Fort Wayne Electric Works. Full details as to construction and connections are given.

Instruction Book No. 3048 from the Fort Wayne Electric Works is concerned with their Type A Form A Oil Transformers. The illustration and text give valuable suggestions on the installation and connections of transformers.

"Practical Operation of Arc Lamps," edited and published by the National Carbon Company of Cleveland, Ohio, contains 76 pages of practical points regarding arc lamp construction and operation. A number of practical tables and a complete index are also given.

Bulletin 13 A from the engineering department of the National Electric Lamp Association gives information whereby any lamp user can select the correct lamp for his needs and technical data on the performance and characteristics of Mazda multiple lamps with drawn wire filaments.

MEETING OF PACIFIC NORTHWEST SOCIETY OF ENGINEERS.

The annual meeting of the Pacific Northwest Society of Engineers will be held at Seattle, Wash., on June 6 and 7. President A. H. Dimmock will speak on "The Place of the Civil Engineer in Modern Civilization." State Geologist Henry Landes will discuss "The Work of the State Geological Survey," and Captain A. O. Powell will talk on "Centralization of State Engineering Work." A dinner will be given at the Commercial Club rooms, followed by an illustrated lecture on the Panama Canal by A. W. Munster. The members will visit the White river-Lake Tapps hydro-electric power plant where they will be the guests of the Pacific Coast Power Company, of which S. L. Shuffleton, Northwest manager of the Stone-Webster Company, is the chief engineer.

NEWS NOTES

FINANCIAL.

BREWESTER, WASH.—An election will be called soon to vote on bonding the town for $7500 to install a municipal water system.

ASHLAND, ORE.—The voters of Ashland have voted down a proposition to issue $27,000 water bonds for the extension and repair of the water system in that city.

WALLA WALLA, WASH.—The Pacific Power & Light Company has purchased the entire holdings and local plant of the Waitsburg Electric Light Company, at about $45,000,

BEACH, CAL.—Qualified voters of the city will hold an election June 27, to vote on the question of issuing bonds in the amount of $850,000 for the purchase of the two private water plants.

LOS ANGELES, CAL.—Certificate of change of principal place of business has been filed by the Bakersfield and Kern Electric Railway Company, from the city of Bakersfield to the city of Los Angeles.

INCORPORATIONS.

BAKERSFIELD, CAL.—Bakersfield & Kern Electric Railway Co. Capital stock, $250,000; subscribed, $5000. Directors, C. R. Eager, S. B. Cushing, H. A. Blodgett, F. T. Whorff, C. N. Beal.

RED BLUFF, CAL.—The Oro Electric Company has been incorporated for $10,000,000, shares $100 each, subscribed $7000 by F. V. Pering, F. S. McAllister, W. B. Phelps, W. S. Wilsey, A. Harvey, E. Buckhaley and W. G. Jack of San Francisco

CENTRALIA, WASH.—The Centralia Electric Light & Traction Company has been incorporated by Walter Copping, G. W. Muck, N. W. Mills. It is the intention of the new company to construct an electric street railway between this place and Rochester, a distance of 15 miles. Practically all of the right-of-way has been secured. The company will also supply power and electric lighting to farmers along the route.

ILLUMINATION.

ELLENSBURG, WASH.—W. W. Seymour in a communication to the City Council asked that his gas franchise be extended for another year.

OREGON CITY, ORE.—The acceptance by A. L. Beatie of the ordinance granting him a franchise to lay gas mains in Oregon City has been filed.

KINGMAN, ARIZ.—The Kingman Gas Company has secured an option on a site for a gas plant to be installed for the purpose of furnishing fuel gas to residents of the town.

PROSSER, WASH.—The county commissioners have granted the Pacific Power & Light Company a 50-year franchise for the transmission of electric power in Benton county.

SANTA ANA, CAL.—The Board of Supervisors has sold a franchise for a pipe line to the Southern Gas Company, the bid of C. S. S. Forney, representing the company of $1000 being accepted.

KLAMATH FALLS, ORE.—The W. F. Boardman Company of San Francisco, is seeking a fifty-year franchise for the erection and operation of a gas plant in Klamath Falls. The company agrees to put in a plant with a capacity for 25,000 population, and agrees to begin the installation of the plant within 60 days from date of signing of the ordinance. The company will expend $65,000 in the installation of this plant.

COULEE CITY, WASH.—The Council has passed an ordinance granting to the Pacific Power & Light Company a franchise to construct and operate electric light and power lines in the streets of the town.

WHITTIER, CAL.—The Board of Trustees of the Whittier Union High School are receiving sealed bids for furnishing electrical fixtures for the Science Hall. Bidders may furnish their own specifications.

COLTON, CAL.—The City Council has awarded a contract to the General Electric Company, Los Angeles, for a 100-kilowatt transformer for $543. It will be ordered at once as it is wanted for service in the carnival.

SAN FRANCISCO, CAL.—The bid of Thomas Day Company of San Francisco to install the lighting fixtures in the addition to the Federal building in Sacramento has been accepted by the Treasury Department. The contract amounts to $2171.

PASADENA, CAL.—Notice is given that the city clerk will receive sealed bids up to June 6, for furnishing a turbo-generator unit with Tirrill regulator and exciter, together with condenser pumps and auxiliaries of capacity of 1500 to 1650 kilowatts.

MADERA, CAL.—F. C. Roberts Company bid $100 for a gas franchise, the company agreeing to file plans and specifications with the cost of installation, giving the city the right to purchase the plant at any time within the life of the franchise at cost and 8 per cent interest on the investment.

GREENVILLE, CAL.—Negotiations have been completed whereby the Indian Valley Light & Power Company has acquired the Dunn water right on the Feather River near Seneca. It is estimated this water will generate 25,000 h.p. of electric force. S. P. Dunn, who controlled the water right for seven years becomes interested in the Indian Valley company. A survey for the ditch and a transmission line to Greenville will be completed within a month, and it is expected that the plans for the power plant will be completed within the same space of time. The capital stock of the company has been increased to $500,000 and the enlarging of the company's plant has been fully financed. The construction of the power plant will be commenced in a short time.

LOS ANGELES, CAL.—Alleging that the assessor was guilty of "fraudulent discrimination" in placing a valuation upon its franchises, the Los Angeles Gas & Electric Corporation has filed suit to recover $24,830.13 from the city, that amount having been paid on a tax levy under protest. The pleadings assert that this company was assessed on a valuation of $2,989,065, while the value placed on the franchises of the Domestic Gas Company, was $49,450. The Economic Gas Company escaped with paying taxes on $100. One of the allegations is that the company was assessed on its "good will." This is declared to be discrimination in that 10,000 business houses were not taxed upon the "good will." It is averred that in the cases of other corporations, the stock was taken at its market value, while an arbitrary value of $150 a share was put on the gas company stock. It is asserted that it had a value of only $100 per share . The pleadings do not intimate any mistake on the part of the assessor, but openly charge him with having wilfully discriminated against the corporation. The company admits that its property should have been assessed at $1,203,065 and that its taxes should have been $16,667.64, but alleges that the action of the assessor has made the entire levy invalid so far as it is concerned.

TRANSMISSION.

HOPE, IDAHO.—This place has granted the Northern Idaho & Montana Power Company, a franchise for power and lighting service on the streets here. Work will soon start on a 14-mile power line.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing officer, Isthmian Canal Commission, up to June 15, for furnishing trunions, line materials, insulators, copper wire, crossarms, etc. Circular 633. Form of bid on file at U. S. engineer's office, Chronicle Buiding, San Francisco.

MADERA, CAL.—The wires of the San Joaquin Light & Power Company are to be extended from Madera to Los Banos, Gustine, Dos Palos, Mendota, and Firebaugh. The announcement of the intention to invade the west side of this section of the San Joaquin Valley was made by Manager A. G. Wishon.

LOS ANGELES, CAL.—The bureau of power development has stated that two million dollars more will be necessary during the next fiscal year. Unless this amount is forthcoming it will be impossible to have the power in Los Angeles by December 31, 1912, when it is expected the aqueduct will be completed. The money is to be used for the Fairmount dam, to construct tunnels and other hydraulic work in San Fransquito canyon.

MEDFORD, ORE.—The Klamath Power Company has entered the field in competition with the Gold Ray Electric Company. A franchise for the use of the public highways has been granted the company in Josephine county and a similar franchise was granted in Jackson county, last week. The company intends its lines to be extended over the entire valley as far north as Grants Pass and will also connect with all the smaller towns.

BOISE, IDAHO.—The Secretary of the Interior has awarded the following electric apparatus contracts on the Arrow Rock dam in the Boise irrigation project, as follows: The Allis-Chalmers Company of Milwaukee, Wis., 3 alternators, 4 auxiliary transformers, and air compressor, contract price, $19,450. The Westinghouse Electric & Manufacturing Co., of East Pittsburg, Pa., 3 air blast transformers and 2 blowers, contract price $5880. The General Electric Co., of Schenectady, N. Y., switchboard, 24 disc switches, 6 electric circuit breakers, supplies, and 2 lightning arresters, contract price $6096.

RENO, NEV.—The Truckee River General Electric, one of the Hammon projects, has commenced a suit against a number of farmers in the Truckee Valley for the condemnation of rights of way over their lands for a high voltage power transmission line, to run from the new electric power plant being built at Verdi, to Wabuska. F. E. Durham and D. C. Wheeler are two of the prominent land owners sued. The company is rushing construction work on its new generating plant. Water is to be taken from the Truckee River at Verdi and carried to a point two miles below town through a ditch 36 feet wide and 8 feet deep. Through a penstock 2100 feet long the water will be dropped 85 feet to the turbines. The plant will consist of one generator that will develop about 3200 h.p., which is to be supplied to consumers at Mason, Nev., and the surrounding country for power and lighting purposes. This plant, under favorable conditions, will be ready for operation by September 1.

TRANSPORTATION.

SAN FRANCISCO, CAL.—Three authorizations to pay for material and work on the municipal street railway on Geary street have been finally passed by the Supervisors as follows: McNab & Smith $4517.33 for hauling steel rails; Board of Works, $2000, for hauling and piling cross-ties, Pennsylvania Steel Company, $12,629.50, for steel rails.

OAKLAND, CAL.—The Oakland Traction Company has been awarded franchises for street railways on East Sixteenth street or the Boulevard and on Fourteenth avenue and Hopkins streets. Both franchises are for 35 years.

TURLOCK, CAL.—The Tide Water & Southern Railroad Company has made application to the Board of Trustees for a franchise to construct and operate an electric railroad track of standard gauge, to be constructed between this city and Stockton. The application will come for hearing on June 27th.

FRESNO, CAL.—Plans have been completed by H. A. Hansen for the office building of the Fresno, Hanford & Summit Lake Railroad, to be located on I street in this city. The building, which will cost $20,000 will occupy two lots, 50x150. It will have a two-story front but will be only one story in height in the rear. The General Electric Company has completed the ground floor plans of the power station of the railroad company.

OAKLAND, CAL.—An ordinance granting the Oakland & Bay Shore Railroad Company, a subsidiary company of the Oakland & Antioch Railroad Company, a franchise in Shafter avenue, has been passed to print this week by the City Council. The action was taken in spite of an opinion by Ben F. Woolner, city attorney, that the council probably had no jurisdiction over the application to lay rails in Shafter avenue to Thirty-eighth street. The franchise grant was only to Fortieth street.

MODESTO, CAL.—The Modesto trustees have passed to print the franchise for the Tidewater Southern Electric Railway. The "exclusive" clause that has been the principal bone of contention, was dropped by the promoters when the trustees agreed that a clause would be inserted in the franchise allowing the Tidewater Southern Railway Company any privileges that any time in the future may be allowed other companies building on the same streets. The action has now made it possible for the company to continue with their road from Escalon as soon as desired.

WATSONVILLE, CAL.—A contract for the building of a concrete wharf at Port Watsonville to extend 1700 feet into the water has been let by the Watsonville Railway & Navigation Company to the Marine Concrete Construction Company of San Francisco at a figure close to $50,000. W. F. Crosby, traffic manager of the company, announces that all of the property holdings of R. W. Eaton at Port Watsonville have been purchased by the railroad company and that the company has a number of plans in view for improving the property. He states also that a regular line of steamers will be in operation within 60 days, running up and down the Coast. The extension of the electric lines through the Pajaro Valley will also begin soon, putting the company in a position to handle a large volume of freight during the coming fruit season.

TELEPHONE AND TELEGRAPH.

NEWPORT WASH.—W. C. Hickman, of Spokane, superintendent of construction of the Pacific States Telephone & Telegraph Company in this territory, has recently investigated prospects for extensions of the company's line from Newport to Metaline Falls.

BAKERSFIELD, CAL.—J. W. Kelly, who is promoting a local telephone company, says he has $50,000 in capital pledged to the enterprise and he expects to make application for a franchise at the next regular meeting of the city trustees. Mr. Kelly declines to make public the names of his associates in the venture, but says that they are all local people. Ultimately, however it is the expectation that long distance service will be provided by means of a through wire connecting the Home telephone systems of San Francisco and Los Angeles.